

Aviation Week

Including Space Technology

June 15, 1959

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AVIATION CALENDAR

June 25-28-1977 National Meeting, American Meteorological Society, San Diego, Calif. To be held in conjunction with the 46th Annual Meeting, American Society for the Advancement of Science, Pacific Division.

June 16-18 16-18th Assembly of the International Civil Aviation Organization, San Diego, Calif.

June 22 Symposium on Pollution in Maritime, Chelmsford/Essex, 22nd, Atlantic City, N. J. Joint sessions, American Society for Improving Education, American Society for Testing Materials.

June 22-25 American Public Ground Meeting and Air Transportation Conference, American Institute of Electrical Engineers, Seattle, Wash.

June 21-22 21st Meeting, American Technicians and Manufacturers Assn., 21 Project Hotel, San Francisco, Calif.

June 24-26 24th Annual National Symposium, Nuclear Industry Division, International Society of America, Hotel Pitts, White.

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AVIATION WEEK including Space Technology

June 15, 1978
Vol. 10, No. 24

AVIATION WEEK is a leading authority in the field of aviation and space technology. It provides a comprehensive overview of the latest developments in the industry, including new aircraft designs, space exploration, and military technology. The magazine is published weekly and is a must-read for anyone interested in aviation and space technology.

AVIATION WEEK, June 15, 1978

Holley Announces A Nationwide Service Network of Commercial

for Efficient Servicing Jet Airlines



Service or replacement of Holley's main piston bleed governors, bleed pipes and bleed valve actuators is now immediately available throughout the U.S.

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The handsome new facilities of the Southwest Airmobile Corporation at Love Field, Dallas, Texas, are headquarters for Holley sales and service for Dallas and other South Texas areas.



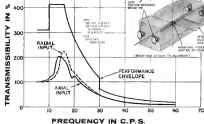
East Coast and Southwestern sales and service are provided through the organization of the Airwork Corporation and its several branch facilities.



vital electronic equipment is "soft mounted" on F-105



Vibration/shock/mounting control—Two integrated electronic circuits in Republic F-105 jet fighter are mounted on special Lord high performance isolators. Isolators transmitted isolation vibration, suppressed external disturbances to 1 G and 30 G shock tests throughout temperature range from -40°F to $+200^{\circ}\text{F}$. In time design shown, two control weighing less than 1.5 pounds each support chassis weighing between 200 and 400 pounds. One of Lord F-105 control temperature tested isolators shown specified damping ratio critical performance two work temperature range. Transmissibility curve shows how critical vibrations isolate keeps equipment well inside supply vibration.



Critical electronic units on the Air Force's Mach 2 F-105 Thunderbolt fighter-bomber are "soft mounted" on Lord vibration control systems. Operational reliability is thus assured for a less bulky computer, night amplifier and two integrated electronics chassis.

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In developing the entirely new hose assemblies, Weatherhead worked on the specifications with Boeing engineers. Shortly afterward, Weatherhead had established mass production of the full range of specified assemblies.

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6. Titanium slabs are heated prior to rolling into continuous sheet only Crucible's process enables for producing high purity metals in all sizes and wall forms, to substantially reducing costs and delivery times.

7. Vacuum Arched Alloys are specified for aerospace bulk used in non-potential and for direction systems. The metals improved properties facilitate maintenance.

8. Titanium alloy slabs for ACME alloy Titanium, which must be vacuum melted, was selected because of its high strength weight ratio, corrosion resistance and corrosion resistance.

9. Basic Melting Processes. Vacuum induction melting produces "pure" metals that contained air melting because it eliminates all sources of contamination around the crucible. Vacuum are re-melting elements the crucible and permits production of ingots up to 15,000 lbs.



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SUPER-DUTY METALS

Marked improvements in properties produced by High-Purity Metallurgy

Behind the development of space-age metals with entirely new characteristics is vacuum melting—a series of processes that produce "pure" metals with better properties.

Why Vacuum Melt? Vacuum melting protects molten metal from contact with air. It also provides closer control of composition, helps eliminate inclusions, and minimizes metal porosity and segregation in ingots.

In the field of vacuum melting, Crucible's position is unique. As the leading producer of special purpose steels, Crucible's experience in high-quality metalworking is unsurpassed. Through formerly affiliated companies, now fully integrated with it, Crucible led in the development and commercial production of vacuum-melted steels, iron, nickel, copper—and titanium. Therefore, Crucible's breadth of ex-

perience, together with its extensive facilities, places the company in the best position to provide the "super-quality" metals most suitable for any given application.

The three vacuum-melting processes—One of the Crucible process in VIM—vacuum induction melting. It starts with very high-purity raw materials, produces extremely pure ingots. A second VIM—vacuum are remelting, or the consumable electrode process. This process, starting with air-melted electrodes, produces large ingots—up to 35" diameter x 15,000 lbs. It provides

metals with low-gas content and greatly improved uniformity of properties. The third process is VES—vacuum are remelting of vacuum induction melted electrodes—a double-melting technique. It permits manufacture of super-pure metals in the full range of ingot sizes.

Crucible's experience with all three processes, and its facilities for vacuum are remelting its own specially air- or

vacuum-melted electrodes, provides industry with a complete range of vacuum-melted metals at the lowest possible cost. Only at Crucible is there available this experience, flexibility and the facilities for vacuum-melting titanium, super-alloys, heat-treating alloys, bearing steels, tool steels, stainless steels, electric alloys and nuclear reactor materials.

If you'd like to know more about Crucible's work in High-Purity Metallurgy, read: "Quality Aspects and Properties of Vacuum Induction Melted and Vacuum Arc Remelted Steels and Super Alloys" and "Titanium for Aircraft and Spacecraft". Write: Crucible Steel Company of America, Dept. AF-11, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.

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The power that makes this possible—120,000 pounds of thrust—is delivered precisely and reliably by an advanced solid propellant rocket.

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SIKORSKY HSS-2

U.S. Navy's new hunter-killer turbocopter

The Navy's new turbine-powered HSS-2 helicopter, developed by Sikorsky Aircraft, is the country's newest anti-submarine weapon system, the first helicopter that can both search out and destroy enemy submarines.

This versatile helicopter, with modifications, is also ideally suited for troop, cargo, and rescue operations of other U.S. military services.

The HSS-2 features a fast hull and two engines from land, deep-sea, water, air, snow, mud or sand. Two turbine engines, each rated at 1000 shp, give it superior range, speed and payload.

Improved submarine detection

equipment and an advanced navigation system developed jointly by the Navy and Sikorsky, combined with anti-icing equipment for the rotor assembly and automatic stabilization equipment, make the HSS-2 an integrated weapon system capable of around-the-clock all-weather operations.

Now in production, the HSS-2 is Sikorsky's second boat-hulled turbocopter. It joins a family of Sikorsky helicopters whose armament is employed in military and commercial operations throughout the world. SIKORSKY AIRCRAFT, Stratford, Connecticut. A Division of United Aircraft Corporation.

EDITORIAL

ANP's Political Pitfalls

(Rep. Melvin Price, chairman of the Research and Development Subcommittee of the Joint Committee on Atomic Energy and a powerful advocate of placing a nuclear power and aircraft into the air at the earliest possible date, outlined the political pitfalls that have beset the U. S. ANP program during the 12 years of its rocky existence in a speech just past its delivery last week at a meeting of the Atomic Locomotion Club in Washington. Rep. Price also expressed the hope that the Administration and the Defense Department may finally be on the verge of drafting a firm program for the development of a nuclear aircraft. Aviation Week is reproducing below major portions of the speech because of its interest and significance to aviation.)

The nuclear-powered plane, despite its advanced technical status, has been with us as far over a dozen years now and has been the object of intense interest and support by the Joint Committee on Atomic Energy of the Congress.

In 1955, the direct cycle propulsion system had been developed to a point where the Air Force proposed to try it out in a flying testbed, utilizing a modification of the B-36 bomber. The technical people in the field now feel that if this program had gone forward vigorously, the chances are good that we would have had such a flying testbed in 1957.

Yet I must remember this B-36 flying testbed concept was effectively spotted by Secretary Wilson in 1955 in his famous "Subspace" statement, and the whole ANP program was virtually cancelled. Only the most strenuous efforts on the part of the program's advocates and the Joint Committee kept the project alive, albeit on a clearly reduced basis.

Then in 1955 the Air Force built up another head of steam for a high performance nuclear bomber, including a complete weapons system, listing its proposals on promising technical developments to that point. This was approved and the high speed project was begun only to die of its own weight in 1957. The disappearance of this concept in 1957 by the Defense Department had unfortunate ramifications for truncating the more complexities of the high performance idea.

The effect of this action, which we can still feel today, was to place the whole concept of effective nuclear flight in doubt as the minds of many people and the period of disorientation around the aviation in Washington trended printing ahead to a successful resolution of the technical problems involved.

In the fall of 1957, a more realistic proposal was brought forward in the Pentagon to proceed with a flying testbed utilizing a modified conventional plane as the carrier of the nuclear propulsion system. This proposal, which was based on sound technical considerations, was on its way to approval by the Secretary of Defense until the intervention of two new and important factors.

One of these was the emergence of a special panel set up by the President's Scientific Advisory. Dr. James R. Killian, who raised serious questions about the necessity of the project technically to go forward to a point type flight program. It is interesting to note that this "expanding group," whose review of the project was

entirely in nature, intervened with the Defense Department in an "advisory" capacity before the Defense Department itself had made its recommendation to the President.

The second factor which emerged at this time was a sudden reversal of interest in the ANP program by the Navy, who took sharp issue within the Defense Department on the dominant role which had been assumed by the Air Force in the program. While I am all for active Navy participation in the program, together with the Air Force, this particular action by the Navy created confusion within the Defense Department as to its appropriate assignment of responsibilities. Before the matter had cleared, the Killian Committee had gone to work and the flying testbed concept once again hit the dust.

In an attempt to meet this question of usefulness which had been raised by the President, the Air Force last year established a requirement for the so-called CASUAL system, which called for the construction of a new prototype aircraft capable of serving as an actual test vehicle and later, with any necessary modifications in the design, as an operational military aircraft. While no approval of this requirement has yet been made by the Defense Department, plans are proceeding and Congress has actually been selected in a competition with Lockheed, to develop designs for the airplane.

I think it must be evident from the brief history I have described to you, that the ANP program has been beset by a multitude of problems under its inception.

Particularly serious after twelve long years, is the fact that the program still has no firm target date for the first flight and our scientists and engineers in the field still don't know where they stand as to the future prospects for the program.

Unless I am sadly mistaken, I think the concept is finally percolating through to those who have responsibility for making the decision on a flight program. I hope so.

Early last month a critical series of discussions was held between representatives of the Defense Department and AEC with regard to possibilities for development of a flight program. I gather the consensus of these sessions was that a draft paper should be prepared for presentation to the President, recommending the initiation of a flight program.

I believe this paper would have gone forward to the President except for the intensely dark of Secretary Quisenberry.

Responsibility for the ANP project has, since Mr. Quisenberry's departure from the scene, been vested in Dr. Herbert York, Assistant Secretary of Defense for Research and Engineering. Members of the committee are acquainted informally with Dr. York and Mr. John A. McCone, chairman of the AEC, a couple of weeks ago to discuss the progress of the program and the question of whether or not plans are being made to go forward with the prototype flight program. At that time, we agreed that the Defense Department and AEC would report to the committee some time this month on what action is to be taken.

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new electronic, in-line data entry or a supply of previously unmet data processing needs are protected by these units. A training program of research and development on computers, robotics, and automated systems lowers the cost. Exotic programming can feature the very latest advances in this field to compress, high temperature resistance, and reliability. They are available to you, special needs and next level technology specifications.

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Frederick E. Hise, a General Electric Engineering Co. of California, Santa Ana (Hise), J. Garraway, president, and Guy E. Estrella, vice president and general manager, Communications Associates Co., Lake Summit, Mo., a subsidiary of Colfax Radio Co.

E. G. Cooke, senior vice president and senior general manager, Trans World, Inc., has also been elected to the board. Robert D. Hall, vice president and general transportation manager, Transportation Division, Eastman, was president and general sales manager, Sales Division. Other new officers of the Transportation Division are Robert D. Medley, senior vice president-flight operations, and J. E. Georger-Mc, senior vice president-ground service.

² Richard W. Cook, Deputy group executive and divisional vice president, American Machine & Foundry Co.'s Government Products Group, Washington, D. C.

B. J. Danovell, var. parvulus (general manager, General Applied Services Laboratories, Inc., Hospital, N. Y.)

Dr. Herbert Tucker, Jr., senior vice president engineering and research, Bellcore Electric Products, Inc., subsidiary of General Telephone & Electronics Corp., New York, N.Y.

John B. Darrsh, vice president and general manager, **the Bond Co.'s** Defense Division, Philadelphia, Pa.

Mr. Gen. Dudley Darnall (USAF ret.) assigned to the position, Cook Electric Co., Chicago, Ill.

Mr. Gen. Joseph D. Golds, Air Force Director of Flight Safety Research, has been appointed to the newly organized Office of Deputy Inspector General-Safety, Washington, D. C.

George F. Harmons, vice president and General L. Wright, assistant secretary, Aerospace Industries Assn., Washington, D. C. Mr. Harmons continues as board and general manager of AIA, and Mr. Wright as executive assistant to the president.

Joseph M. Rouse has been named National Aeronautics and Space Administration's Small Business Advisor.

Honors and Elections

Mag. Gen. Otto D. Brown, Jr., Commandant of the Air Force School of Aviation Medicine at Randolph AFB, has been named president of the Air American Medical Ass'n's Section on Space Medicine.

Dr. Aaron J. Klein, a Medical Corps captain serving as a flight surgeon at the 404th U.S. Air Force Hospital, Englewood AFB, has been selected as the recipient of the second ALFA Fellowship in Civil Aviation Medicine at the Ohio State University School of Graduate Medicine.

(Continued on page 102)

INDUSTRY OBSERVER

■ **National Aeronautics and Space Administration** is investigating methods of detecting the severity of *spastic winds* now caused by picking up dust under the command surfaces, a "ion shot," the most gross of it is that the volatiles of the atmosphere. For this reason, NASA has developed a language research winds which form a secondary package to an attitude of approximately 70% per. At peak attitude and olive separation of the fuel stage, these small nuclei vectors in the package for in quick succession, driving the package back toward earth at speeds of approximately 15,000 mph. An initial vehicle in the program has been limited. Most chassis (United States of Technology) is located laboratories is co-operating in the project and providing the rules and an attempt to detect the "ion shot" given off by the velocity package.

► **Thompson.** Rensselaer Polytechnic Institute officials are continuing search for a suitable buyer for Space Technology Laboratories. Negotiations with several educational institutions recently have fallen through over questions of price.

► First XLR500 RM-3 liquid propellant rocket engine for North American's N-15 research aircraft is on its way to Edwards Air Force Field, near Lancaster, California. The engine is being built by Thiokol Chemical Corp. First engine is a two-chamber powerplant and will be used on ground tests and run-ups to promote experience in testing, handling and other procedures. Ground tests will start for a second non-firing engine which is now undergoing qualification testing and will start for the Air Force's Mojave and stand on Edwards AFB. The first flight engine of the XLR500 RM-3 will be delivered as scheduled in July (AWM Mar. 28 p. 30). Actual flight testing of the N-15 with the new engine is still expected to take place some time this fall. Initial power for the N-15 pending installation of a single XLR500 RM-3 is being supplied by two Rocketdyne Ramjet RL15 engines.

►Cancellation of the Ford F150 engine program has forced a reorientation of the development of Northrop Grumman's Q-4 target drone. The drone, now designated the Q-4B, will be refitted for the General Electric B5 with cancelled deliveries to the Air Force scheduled to begin in 1994.

► To provide a more rapid-and-reversible-loss for comparison with solid propellants, liquid propellant rocket manufacturers have generally agreed on 1,500 psi combustion chamber pressure as the pressure standard for igniting liquid propellant performance. This is the same pressure that is being used in the calculation of solid propellant performance and gives a higher loading than the 100 psi, 500 psi and 600 psi combustion chamber pressures commonly used in the past for igniting liquid propellant performance.

►Winghouse Aircraft Division has been formally notified by North American Aviation that it has been selected to develop and produce electronic communications system for the B-70. North American originally picked Winghouse over a team headed by General Electric and Radio Corporation of America but the choice was questioned by Wright Air Development Center (AW May 18, p. 25).

► Then, 5th Corps B-60 Mark II bomber is now well along the final assembly line at the Ft. Worth Division. Cannot Air Force instructs for the B-60, now 106 months.

► **Operations and maintenance of the power facilities for the SAGE/Backing Bowser bases in Air Force's Northeast Air Defense District will be conducted by Wyle Engineering Co. under a \$22 million USAF contract. Facilities will be located at McGuire AFB, N.J.; Stewart AFB, N.Y.; Syracuse AFB, N.Y.; Toulon AFB, Mo.; and Fort Lee, Va.**

► Federal Aviation Agency has asked Defense Department and the airlines to relinquish half of five megaregions of radio spectrum by July, 1958, for use in expanding traffic control facilities. Airlines oppose selling to give up two megaregions hatched out of them, but Defense. Defense insists is opposed to giving up 132 to 135 mc. band now planned for use with Nike Zeus ICBM defense missile. The President is expected to override Defense Department objection.

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AVIATION WEEK, June 18, 2007



.....MISSILE GUIDANCE OUTPOST.....

The Radio Cassette-Driving Circuit designed and produced by Stavid for the RADMUS missile provide the Navy a means of jam-packing electronic driving power against targets in hostile territory. Subminiature size equipment are capable of controlling the missile in flight, and provide remote control with an automatic protection of timing and range information through data-linkage with no remote component.

Stavid's electronics capability is uniquely demonstrated in this work which required design and manufacturing skills ranging from the smallest to the complex — all developed and produced within our facilities.

The Stavid capability ranges from original research to system redesign for mechanical production. Recent accomplishments include:

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- Radio Cassette for R-16 Aircraft
- Beacon Telemonitoring System

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Imaginative Electronics...



Stuart Berlin, Executive, Robert Robinson, Inc. is now responsible for electronic development, including project direction of guidance systems, electronic simulation and fire controls.

Outstanding engineers and technicians are invited to acquire new opportunities in Stavid's advanced systems engineering areas.

Washington Roundup

Unicom Decision

With far as Anco decision on a contract to lead the new Unicom global communications system, next development program within the next three months probably in July. First round of competition have submitted bids. The program is to some extent comparable to Air Force's recently launched RSL communications system, research and development program headed by International Telephone & Telegraph Corp.

'Moster' Air Defense Plan

A "master plan" for U.S. air defense reportedly clicking with the Defense Department and Administration decision to produce both the Air Force's new defense system and the Air Force's new defense system. The plan is to produce both the Air Force's new defense system and the Air Force's new defense system. The plan is to produce both the Air Force's new defense system and the Air Force's new defense system.

The plan was, however, still far from certain to both Congress than that originally requested in the Administration's Fiscal 1969 budget and more aggressive in North American F-108 Mach 3 intercept program.

A revised program for, or at least a new look at, no defense was again by Congress earlier this year after close and counterproductive regarding the relative worth of the air defense program in the past defense. The House Defense Appropriations Subcommittee, after hearing to the air defense program of the Air Force, and Anco officials during Fiscal 1969 budget hearings, called for an immediate reevaluation of the entire program of the highest level.

Symington: More SAC Funds

Wilmington, S. C. Symington (D-Mo.), a member of the Senate Defense Appropriations Subcommittee, last week reinforced his criticism that the U.S. is spending "billions" for obsolete air defense systems which "could not prevent heavy losses" in the event of an attack, when the nation should be modernizing the Strategic Air Command, its major air deterrent power. Under the present program, he said, only 10% of the Air Force's B-57 bombers are scheduled to be replaced by the Convair B-34 Mach 2 bomber over a three year period.

NASA Budget Approval

Authorization for the National Aeronautics and Space Administration's full Fiscal 1969 budget request of \$415,700,000 passed Congress last week when the House accepted Senate amendments without sending the bill to conference. The measure authorizes appropriation of \$44.4 million for studies and research, \$111 million for research and development and \$351.3 million for construction and equipment for Fiscal 1969.

Senate amendments accepted by the House are: • Reduction of \$4.7 million for construction of a new control facility for high speed, solid and liquid fuel rockets previously directed by the House. • Restructured House provisions that would permit use of research and development funds for capital items by requiring NASA to first notify both the House and Senate upon completion of the action, location and estimated cost of the facility.

• Deleted fiscal date of July 30, 1969, on a provision which requires prior congressional authorization of NASA appropriations, thereby making the requirement one of indefinite duration.

Contractor Security

NASA reported last week that it also has completed an agreement for the Defense Department to act on its behalf in security matters relating to contractors. Under terms of the agreement, the Defense Department will issue security clearance to employees of NASA contractors and support contractor facilities and operations. The agreement applies to both contract administration by one of the military departments for NASA and those administered solely by NASA. The Defense Department, by issuing its Industrial Security Program available to NASA, has eliminated the need for the agency to establish a similar program of its own.

Air Transport Panel

Carl Albert's House subcommittee on transportation and surface transportation is scheduled to hold a hearing in a panel discussion on legislative, administrative, problems affecting the industry, today at a hearing of the House Subcommittee on Legislative Oversight. Topics for discussion include:

- Legislative or administrative measures which have been or should be taken to provide an attempt to influence fiscal matters or employees
- Role of leasing companies and what legislative measures should be taken to increase their effectiveness
- Role of communications, security, safety and security, efforts, efforts of responsibilities and the present strength and weaknesses of the transportation system
- Efficiency of the Board and changes necessary to existing structure, personnel to enable its recommendations to cope with the increasingly complex volume of business causing delays there

AAXICO Request

AAXICO oil-charge domestic carrier, which asked the Civil Aeronautics Board for a subsidy relief some three years ago (AW April 15, 1968, p. 40) is now requesting an increase in its subsidy. The Board has approved the request for a subsidy of \$1.5 million per year, June 30. The carrier has been losing low subsidy on loss out of seven flights (Air Force) contracts which, it believes, should run more than \$12 million.

Mobile Lounge Contract

Federal Aviation Agency has announced the letting of proposals for design, construction and testing of a prototype mobile lounge to be used for terminal-to-terminal passenger transportation at Washington International Airport, Clarendon Va. (AW April 15, p. 41). The agency has not a true vehicle making the completion of the prototype, mechanical and engineering features by Feb. 1, 1969, and a complete prototype plus production plans and specifications by May 1, 1969. The service, testing of the prototype will be conducted by the contractor at an airport selected by FAA before the vehicle is tested over to the agency for final acceptance.

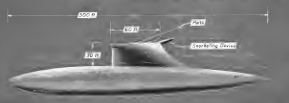
—Washington staff



Soviet Missile Launching Submarines Sighted

Two types of Soviet missile submarines have been sighted on operational patrol in the Atlantic. Aviation Week staff's computer database has been identified as a long-range sea patrol vessel, which reportedly is a long-range submarine. Its full propulsion system was observed on the 13th high cruising tower. Missile test runs (see article) are also in progress. Both may be launching submarines as well as used to launch off coast guard of America. It is not known whether

launches can be made from below the surface. It is known, however, that it can come from its home port to a position near Rio de Janeiro, stay on station for 20 days and then return still without positive evidence of sea-surface, while on station. (Picture of the Soviet submarine (above), also a modified version of the 35 class with an enlarged cruising tower, was taken recently by a Navy patrol plane south of Iceland. The submarine's crew of members, which was also probably taken, may be located in the cruising tower.)



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Air Force Tightens Contract Procedures

Additional auditors employed; plan to notarize cost statements approved in wake of GAO report.

By Katherine Johnson

Washington—Air Force last week took steps to tighten its control over cost pricing, responding quickly to the congressional clamor touched off by a General Accounting Office report which charged excessive pricing of \$30 million in 14 contract cases with military (AW June 8, p. 28).

GAO declared that the overpricing was due to the fact that prime contractors knowingly incorporated subcontract costs or inflated into fixed-price, rather than negotiable, contracts as new types of equipment in which there are no cost guidelines so that USAF had been negligent in catching ineffectual errors in contracts.

Philip B. Taylor, Assistant Air Force Secretary for Material, who and USAF responded the GAO report, "line and constructive," told the House Armed Services Investigating Subcommittee that

• Funds have been transferred from other accounts so that 202 additional auditors can be hired to police procurement contracts. At present, the Air Force has approximately 1,069 auditors in its employ.

• USAF agrees to a proposal to require contractors to have their cost statements reviewed, as that is in the case of income tax returns, they could be subject to prosecution for any willful misstatement. Subcommittee chairman explained that Air Force's original plan for certification of contractors had not "worked."

USAF has already obtained orders from most of the contractors in the area of overpricing due to excessive contracts. Those costs totaled \$13 million out of the \$30 million.

Major Costs

Details on the three major cases involving a total of \$15 million, as outlined in the House Subcommittee, are:

• **Boeing Aerospace Co.** GAO claimed subcontract costs paid by the company on two B-52 contracts totaling \$72 million were excessive by \$1 million. Boeing has agreed to a \$1.1 million reduction. Air Force and it is still "not satisfied." Later, William M. Allen, Boeing president, made a statement saying that "The GAO has not at all stated the Boeing company of had been in their position, LAG several other companies, Boeing has submitted all payments...." Too often, criticism of individual transactions, such as these, results in suspension of government profits, whereas in fact other contractors developments (such as profit reduction). The important figure as those relating to the complete program, Boeing production are based on these

total costs collected in the company's modest earnings.

• **Lockheed Aircraft Corp.** GAO and subcontract costs for various components for C-130A transports were overpriced by \$41 million. Lockheed has agreed to a price reduction of \$19 million, substantially more than the GAO claim.

• **McDonnell Aircraft Corp.** GAO charged that contracts paid by the company in negotiating a target price of \$20 million for USAF F-101A aircraft contained inflated subcontract costs which McDonnell knew were \$13 million.

less higher than it was going to pay. Unable to reach agreement with the company, the Air Force has turned the case over to further Department.

Meanwhile, there are three major developments in such as:

• **House Armed Services Investigating Subcommittee** headed by Rep. Edward Robert (D-La.) will begin public hearings next month on the hearing of House military affairs and defense subcommittee of Department of Defense is, companies doing business with the military.

• **General Accounting Office** will release a report covering, emphasizing on Navy aircraft and military contracts to Congress early in July.

• **Senate Armed Services Subcommittee** headed by Sen. Strom Thurmond (D-S.C.) is tentatively scheduled to begin hearings on military procurement legislation on June 21.

Robert Probe

Rep. Carl Albert (D-Cal.), chairman of the House Armed Services Committee, will conduct continuing congressional hearing, directed the Robert subcommittee to move forward with the investigation of former military officers employed in defense industries. An

Japanese Near Fighter Decision

Recent rumors in which U.S. officials in use in at Self Defense Forces the Japanese F-104/F-104C will be made before the end of this month, rejecting a contract between the Japanese Defense Agency and some version of the Japanese Diet.

Japanese Defense Agency still faces the Government plan, which was introduced in the Diet by the Diet, in 1964. The Diet plan was sharply opposed by some members of the Diet who favor the F-104C. Their strongest opponent being the Lockheed plane is the price of \$110 million per plane offered to the Japanese government, plus the Japanese F-104/F-104C. The report was about \$1 million. This price per plane was proposed jointly by the Government and Mitsubishi Heavy Industries to order of Japanese Defense Agency, after the tentative decision.

Finding within Japanese Defense Agency is that the F-104C price would be more than \$1 million when specifications are complete. It was pointed out that F-104 price for West Germany was about \$1 million per plane.

It is pointed out that a contract in the Japanese Defense Agency is comparable to the situation existing, and how both countries (originally, the Agency would \$80 million. But it was discontinued to about \$20 million. Both countries were ordered, the quantity was would be changed, but being in that cost more than two percent of F-104C would be needed. Engines for both would be General Electric J79 engines.

Sources indicated that if both fighters are chosen, the F-104C will be built by Lockheed at Burbank, Calif., and the F-104/F-104C will be built by Mitsubishi. Agreement for these aircraft would be between SW-1A (advanced version) as four without testing, which has a historical record of being more than 100 percent of the cost, causing its effectiveness in the future.

Later on, the Highways G-10/F-104 or the Japanese Spacecraft will probably would be used. Choice of a defense missile will be decided by the type of aircraft for actual orders which by Japanese Defense Agency. Services under consideration and competing are a modified Hughes SG-10 system and a modified Westinghouse Aero-10 system.



Nike Zeus Blast Pit Completed

Blast pit for Nike Zeus anti-missile launch complex is completed at White Sands, N.M. Missile launchers and view of the launcher is at the top of the deflection pit. Facility is part of a \$4 million construction job in preparation for Nike Zeus tests.

recommended to the Fiscal 1960 defense budget which would have banned commitments to companies having soldiers who had been killed from the military service for less than five years was narrowly defeated on the grounds that the Armed Services Committee would undertake the investigation and consider legislation in the field. The amendment, sponsored by Rep. Alfred S. E. Sorenson (D-N.Y.), was first passed 116 to 111 on a standard vote, then defeated 325 to 147 on a roll call vote.

'Unhealthy Situation'

Rep. Sorenson told the House that the influx of former military men into defense industries "is a very unhealthy situation and should be changed immediately. It can have a very definite effect on contracting policies and procedures within the Defense Department. It can result in unnecessary expenditures and waste."

He added:

"Persons within the Department who may be looking forward to possible employment within a certain organization after retirement can display glibly and fearlessly without ever realizing it. Further, government workers engaged in government can bring a great influence over their former subordinates who are still in the Department. Contact of social and professional gatherings between active and retired officials can provide a perfectly natural setting for

influence and favoritism." The three members being considered by Sen. Thurmond's subcommittee are:

• Legislation sponsored by Sen. Lyndon B. Johnson (D-Texas), which was an outgrowth of his own hearings on the Soviet satellite situation reported by the Senate Preparedness Subcommittee headed by Sen. Lyndon Johnson (D-Texas). Philadelphia behind the bill is to accelerate the production of advanced weapons and cut back on handicapping research, clerks and audits (AW Aug. 18, p. 26). With the sharp change in congressional attitude that has resulted there is little likelihood of favorable action on this measure at this time.

• Legislation sponsored by Sen. John McClellan (R-Conn.), which would speed up the production of advanced weapons. It has gained substantial support in Congress. The only justification for major defense programs is to be in cases where public disclosure of the government would involve national security or where a major product were involved. Reports on all suggested procurements would be submitted to the U. S. Attorney General.

• Legislation headed by the House-Senate New York delegation which would require annual competition in negotiations. The New York delegation has a strong record in this area. If there were more competition, it could and should procurements are concentrated in the West Coast area would shift to New York and other eastern states affected with high unemployment.

Contract Control

In reporting improvements in fiscal control over contract work in the Military subcommittee, Sen. Thurmond said that the subcommittee that the controls should not be so extensive that they "defeat the positive results of defense."

Gen. Samuel E. Sumner, commander in chief of the Air National Command, and Maj. Gen. W. A. Davis, deputy director of the procurement at SAC, strongly challenged earlier testimony by Air Force press secretaries that they, rather than USAF, Weapons Systems Program Office was weapon systems manager of certain defense projects. The contractors near North American Aviation Inc. (AW Aug. 20, p. 11) Lockheed Aircraft Corp. (AW Aug. 27, p. 11) and General Dynamics Corp. (AW Aug. 14, p. 25).

From their testimony, Gen. Anderson said he was not at all sure that he knew their functions. Gen. Davis said "It is the responsibility of the Weapons Systems Program Office to plan, program, direct and control all efforts of the particular weapon system in connection with the Air Force program without functional duplication of the work being performed by the contractor."



Second after drop from 85,000 feet, X-15 tests white phase of hypersonic potential fuel used for control system operations.

X-15 Makes Successful Free Flight

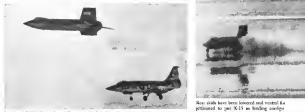
Edwards AFB, Calif.—North American X-15 upper atmosphere research aircraft dropped away from its Boeing B-52 mother ship last week to begin a successful 9 min., 10 sec. free flight before touching down at Rogers Dry Lake basin. Test pilot Scott Crossfield termed the flight an unqualified success.

Released from the B-52 at a speed of Mach 0.80, the X-15 glided in a large S-curve during which the effectiveness of control landing and flaps was judged. The aircraft touched down at 160 ft., in a field more than 100 ft. from the runway. The two stall canards caused the nose wheel to contact the ground almost immediately with what appeared to be considerable force. No gear contact, however, was not in good or bad

reported. Landing run was about 440 ft.

Visual aid of the X-15 was provided by the B-52. During descent, the aircraft passed through several layers of high-altitude clouds. Crossfield said there were no problems as he attempted to avoid the danger of control effectiveness available in the landing configuration.

Drop altitude of 115,000 ft. was reached 20 min. after launch. Weight of the X-15 at drop was slightly more than 11,000 lb. Next step in the series of demonstration flights will be conducted by North American Aviation before leaving the X-15 over to a joint National Aeronautics and Space Administration-Air Force Navy team will be a captive flight at maximum gross weight.



Lockheed F-104 chase plane follows the X-15 flight. The X-15 carried no rocket fuel.



Roll axis has been lowered and control is maintained to get X-15 in banking angles when. Note high angle of attack angle.



Boring DM-910 Bomarc intercepter missile is delivered (left) to a Douglas C-124 Globemaster to first stop at Air Force Missile Test Center's Cape Canaveral, Fla., assembly and launching area. At right the missile, on ground handling dolly, is hoisted down ramp. Metal cover protects rocket nozzle.

USAF Test-Fires IM-99B Bomarc for First Time

Control and stability of Bomarc B during the first seconds of flight are provided by a pyrotechnic reaction jet in the booster, similar to those in Polaris and Snark boosters. Internal configuration of DM-910 is practically unchanged from the earlier DM-90A.



Bomarc B is moved to No. 4 launch pad. The missile has a Thielbolt solid unperforated boost rocket. Weight of the Bomarc B is about 455,000 lbs., compared with about 250,000 lbs. for the Bomarc A.



Bomarc was released to delivery with protective cover to No. 4 launch pad. Bomarc B has the ability to accept a mission with its improved target seeker and strike any target it finds.



Bomarc DM-910B is fired for the first time. Cruise propulsion is delivered by two Magnesium Eight (M8) engines (AW Mag. 11, p. 72). Booster fuel is JP-4 which takes less 10 seconds, which simplifies logistics, since it is plentiful at USAF bases.

NASA Plans Telescope-Bearing Satellite

San Diego—Polishish planning and more direct cooperation now is under way for a satellite astronomical observation platform, it was disclosed at the American Rocket Society annual meeting here last week.

Reference to the National Aeronautics and Space Administration project was announced by James Koppelman, Jr., of NASA's Washington headquarters. He indicated that present thinking envisions a maximum telescope size of 16-in. as an outgrowth of a total 2,500-lb payload, as an outgrowth of satellite size, telescope or combination of telescopes and other equipment.

Orbit distance would be 180 mi. in a path as nearly circular as possible. Additional stabilization is accomplished, maneuvers would be accomplished with 1/2 in. of arc. Attitude stabilization and changes would probably be by means of

thrusters, Koppelman indicated. Control would be remote, with the required instrumentation power obtained from solar-type sources.

The instrumented station would be used for a variety of purposes, Koppelman indicated. At the 700-mi. distance, in a perfectly circular orbit, the satellite's orbit would be in the order of 200 years, and the end of the project of the satellite was it intended to accomplish would bring an end to the vehicle's usefulness rather than any actual type failure.

It was indicated also that such a satellite, unless they are allowed to remain in orbit after its usefulness was expended, might stay from launch a direct mission which could be returned and the vehicle derelived.

Polishish planning which deals with "what do we want to do next" then how do we do it, it was being accomplished, Koppelman said, after the very best use in two-phase configuration would be sufficient to accomplish the flying and orbit operation tasks.

Space Seng

Among the factors to be considered in operation of such an astronomical platform, Koppelman said, is size as space, which is a collection of refinements which occasionally appear and diffuse space, which is in it is reduced by the ground-based phenomena which give rise to the work. At its planned maximum altitude, the satellite would be made, the V-45A station built, allowing a certain degree of latitude in the method of gathering and transmitting data to the ground the instrumented observation platform.

Under such a plan, the satellite would include remote station, observation station of data in the far ultraviolet spectrum, and observation to indicate which would be used to detect solar elements on the order of 10 light years distant.

As planned, according to Koppelman, the actual satellite would be composed of the telescope and its auxiliary and control equipment, with suitable shielding, rather than a separately designed vehicle with the telescope or telescope and associated equipment added. This type of design would save weight and improve ability of the available 2,500-lb. payload.

One station described by Koppelman would be composed of a combination of two telescopes, each with the same collection but with different fields of vision, different mechanisms of the same about such data.

For the main astronomical observation platform being sent into orbit, a

one study would be conducted, and this one as to the planning stage, Koppelman said.

This would make use of equipment including 200 mi. and would use a "Two Delta" launching vehicle.

A new name for an old facility was disclosed by Dr. Deane Price of USAF's Wright-Patterson. Called a "Space core holding facility," it essentially is a facility where space core would stay and move later stages and last up-to-date mission being prior to a space flight.

The facility, which would be similar to those used in World War II before plans were assigned to operational squadrons, would make much use of multiple computer simulation equipment and provide controlled living conditions to provide selection of space pilots by such factors as skills which could allow or short space flight.

A facility which serves directly in the space core holding facility, the test center, which is being built at Cape Canaveral, Fla., for the Mars mission.

The new design which space pilots would be held in the facility, since an indication of how few weeks remained in 12 weeks remained. During this period, the pilots would be able to work problems in multiple capabilities in the core, which is in it is reduced by the closed-loop systems existing actual.

Operational Atlas

San Diego—Long-range operational systems, which will be the future International Battle Mobile at Vandenberg AFB only the means. May Gen David W. Jones, commander of the Air Force's 1st Air Force, which is part of the American Rocket Society meeting here last week.

While acknowledging that for most Atlas launch, there will be C-130s, there will be D-130s, which will be the Atlas launch, but related to it in what he does. However, it is known that Atlas cannot be used in the operational configuration from the operational side with mission is given by the Air Research and Development Command subsequent to the successful launching of a satellite of the same kind.

While and he was aware which such thing in the current problem was allowed a Atlas launch and whether without these factors, the program would be short or behind the schedule.

Plans for a combination demonstration operational test of the Atlas launch at Vandenberg base, W.D. said.

ing to control inputs. The equipment might also avoid monitoring by looking in terms of a function of pilot control inputs so that management could be maintained, using pilot techniques to operators and control system time to maintain.

Mercury astronaut will work at the facility prior to their actual mission task. Price indicated, adding that this also would be true for the future space core, that is, they would do much of their later stage work at the holding facility prior to being released prior to their flight.

How this added, problems of a hands-on and such have to be solved in the C-130, it is a willingness of both sides to put up with the unusual circumstances which are inherent in military life and special their unique work.

The facility would be such for post-flight debriefing, according to an overview as quickly as possible, under the best circumstances possible, of unexpected events which occurred during the flight. Additionally, he said, such a mission could be lost due to the multi-component equipment, and multiple capability facility which will be a part of the holding facilities. Reactions have, immediately after the flight would be much better than a status report. Post-incident, Col. John P. Shipp, president of the American Rocket Society and director of the Aerospace Field Laboratory at WADG, said he believes that some of the most difficult problems in human factors research will be the Mercury project are not getting sufficient attention.

Shipp said that while there are more problems in the project, there are a number of variables which would be added with all variables being taken into consideration. One of these is the problem of what happens to the space pilot during months of the mission, which is the case, that is, the system from 100 and 200 mi. Also, what happens in a paragonized scenario where the pilot is unable to control the trajectory and maintain a course? However, Col. Shipp declared that so far, the human factors work for project Mercury undertaken at WADG is going well.

While in a driving motivation for the last possible satellite and equipment effort in Project Mercury, Shipp said, once while the space pilot would be a major motivation element, those requirements and demands which created the vehicle and mission would be maintained and would have to be maintained, just up the power and maintain the project, in was the case in Vanguard, only with a greater loss than a missile.

Space Outpost 11 Details

San Diego—Details on Outpost 11, a five-ton satellite orbiting at 300 mi. from earth which could be used as a space laboratory and training station for space flight research, will now go to members of the American Rocket Society at the annual meeting here. James K. Donaghy, manager of Coastal Astronautics Division, said the satellite would be located after orbit by a Cosmos, composed of an Atlas booster pushed by a 13,000-lb thrust Pratt & Whitney liquid oxygen and liquid hydrogen rocket engine.

The station is designed for four man plus equipment to perform basic scientific tasks which require space environment to yield true and accurate data. Configuration has the crew area to control some sections of vehicle. At launch, this is attached to the Cosmos upper stage. After orbit capture and distribution the Cosmos section is released from upper Cosmos tank on two release points 20 ft long. This is done to get a long moment arm, since this station will rotate slowly about its longitudinal axis in order to provide a 1/6 second gravity for station occupants.

Space Technology

Jupiter Test Indicates Division Of Cells Can Develop in Space

Washington—Cell division and the fertilization process can survive and continue to develop in a space environment, according to scientists doing microgravity experiments.

Several and growth capabilities were confirmed in one of four experiments housed in a Jupiter intermediate range ballistic missile which also carried two earth-mounted parabolic 1,500 mi. range and to an altitude of 180 mi. on May 23 (AP Wire 1, p. 37; June 8, p. 18).

In the experiment, six cells were launched containing six nuclei eggs in both fertilized and unfertilized conditions. Eggs in two of the six were launched when they were placed in the nose cone approximately 1 hr before launch. These six cells were taken out for testing by triggering mechanisms during countdown.

Dr. Richard S. Young, biologist at the Army Research Office, said: "The results of the experiment indicate that the fertilization process can survive and continue to develop in a space environment." The cells were still developing late last week.

The eggs launched during flight have been fertilized in some cases during flight. Dr. Young, who was a delegate to the experiment as a whole, said "generally encouraging," and the distribution was have been noted by the scientists and the results of the experiment. The flight and it is only as possible to improve progress of the fertilized cells to the cells during the steady period in its effort to stop the development of the eggs and permit a study of the

test that had been created under a space environment. Fertilized eggs, Dr. Young said, have much greater resistance to vibrations than unfertilized eggs.

ARMRA scientists believe that the development of eggs fertilized in flight can be achieved in future experiments by further enhancing of their cell nucleus and by selecting a different buffer.

Dr. Young indicated the results of the experiment at Ft. Belvoir, Mo. June 23, 1968, which was the first of the Navy's which launched the Jupiter nose cone.

Final justification of the experiment at the Air Force Missile Test Center, Memphis, at Cape Canaveral, Fla., and planned to be launched in the future were carried out by Dr. Charles M. Nye of the Florida State University and an ARMRA consultant and Don Cochran, of ARMRA's Research Projects Laboratory.

The Research Projects Laboratory also was responsible for conducting the entire test tube fertilization experiments carried out in the Jupiter nose cone. Four of these using human blood serum from three and four by three and sent in a study of solution which were sponsored by the Army Research Office, Biological Laboratory, Dayton, N.Y. Young, a 1968 experiment to determine the effects of radiation on cell growth. This is one of the experiments in which have been conducted.

The equipment necessary for all the biomedical experiments was built by ARMRA's Structures and Mechanics Laboratory.



Setting the stage for over-ocean probes into space, protecting our borders against attack, a vast Radiation-resistant SPACE COMMUNICATIONS network extends from tropical Hawaii, far below our western horizon — spans the broad breadth of America, encircles half the Earth — and reaches bleak Antarctica, far below our eastern horizon. Listening and tracking . . . this far-flung network lends an over-ear ear to the sounds of space, friendly or foe-boding.



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Thiokol Finds Promising Approach To Solid Boron Rocket Propellant

Des Moines, N. J.-based Avco Rocket Fuel has moved much closer to producing a new class of boron rockets for the chemical research group here at Rocket Motor Division of Thiokol Chemical Corp.

Identified with its carbon derivatives of boron hydride with the general formula BH_2C_n , the new group of molecules is expected to lead to new high energy, boron fuel stock can be put into development and test fired on a large scale by the end of the year. Its combination with the advanced molecules such as interpenetrating new under development by Advanced Research Projects Agency contractors, the new boron fuel will produce 10-15% more power than present solid propellant, according to Rocket Motor researchers. Even with conventional oxidizers such as ammonium perchlorate, the new fuel is expected to show a slight gain over present solid fuels. But the reaction between the new boron fuel and conventional oxidizers will not produce the type of combustion products required for a significant energy gain.

Rocket Motor researchers have been firing solid boron fuels for a year. Up until this time, however, they have not been able to get enough boron hydride groups into the fuel polymer to produce sufficient energy to make it worthwhile to put the fuels into development.

Working on the problem since 1956 under a prime Air Force contract, the Rocket Motor group has been trying to put boron hydride into a solid fuel polymer in place of the usual carbon atoms. Ideally, the group would like to substitute boron atoms for all carbon atoms and produce a completely amorphous polymer. But it appears this appears to be impossible task, from what is now known, some carbon steps will always be required to control the polymer's fuel chain.

Getting away from the conventional boron hydride groups into the fuel polymer, however, proved to be a difficult problem in itself. The conventional boron hydride molecules were too reactive and unkind with the usual chemical compounds preventing the proper cross-linking and extrusion of the polymer chains to produce the desired solid propellant configuration. Moreover, when a few boron atoms were successfully substituted for carbon atoms, the resultant fuels were usually short lived.

Then, in 1957, Rocket Motor

chemists developed a new carbon-boron structure. But as so many scientific developments, the significance of this new class of boron molecules was not realized immediately. Later it was discovered that the new group could undergo reactions that the conventional boron hydride molecules could not. Moreover, the new class of boron molecules did not interfere with the reactions required to produce the solid mass and polymer. Nor did the fuel fuels prove short lived, as was the case with the conventional boron hydride fuels. For the past year, the Rocket Motor group has been working on developing the full potential of this new class of boron hydride derivatives, making new derivatives, substituting more and more of them into solid fuel polymers and test firing them on a small scale. By the end of the year, the group expects to have what it has been seeking for the past three years—a solid boron rocket fuel with enough energy to permit consideration for production.

Meanwhile, a number of chemical companies have been working on the development of new solid oxidizers for

the boron fuel during the past year under contracts from the Advanced Research Projects Agency (AW No. 3, p. 54). Some of them have reportedly made important progress in their progress and are expected to have new oxidizers available for testing within six months.

News Digest

Mr. Gen. Clarence S. Irwin, who retired April 30 as a four-star general and who has retired from his position as president and director of planning of Aero Manufacturing Co. Gen. Irwin began his military career in 1918, served in depth command for four divisions and various positions in the United States, before becoming deputy chief of staff in 1955.

Thiokol's engine for solid-fuel Minuteman intercontinental ballistic missile will be developed by Hercules Powder Co. after a \$15,325,000 contract awarded by USAF's Ballistic Missile Division. The bulk of the work will be done at Rocket, Utah.

Sperry Gyroscope Co. Division of Sperry Rand Corp. has received researching \$47 million for development and production of AN EPB-17 air search radar antenna. The high powered radar will be integrated with the Contractual Aircraft Control and Warning System. Selection and identification of aircraft and air targets are made by AN EPB-17. A smaller radar, part of the AN EPB-17, is under investigation at Research Aircraft Control and Warning Systems Air

Contractual agreement to operate regular air service between Vienna and Moscow has been agreed by Austria and Austria Airlines. Austria Airlines' regular flight was made by a Vickers Viscount turboprop transport.

Electronic Industries Assn. estimates it's a \$100 million, then \$14 billion for civil and military space technology through 1975, at which approximately one-third (\$4.5 billion) will go for electronics. During the same period, the total of the civil, defense and space Administration's budget devoted to electronics is expected to rise from 1950 to reach 45%.

New Exams of Ship has installed a multi-million dollar contract to Bell Helicopter Electric Products, Inc., for development of communication systems for the Polaris missile program.

North American Aviation plans to acquire the Fats-Wheeler Corp. were dropped last week.



Fifty-five 707s rolled out for seven airlines

Fifty-five Boeing 707 jetliners, bearing the colors of seven famous airlines, have rolled out of Boeing's Renton, Wash. region, plant. Nearly 35 have been delivered. In all, 390 Boeing 707s and 720s have been ordered by 36 airlines and by MATS.

Already, 707s are in scheduled service by Pan American, American, TWA, and Continental airlines. Soon Qantas will begin 397 operations. Deliveries, later this year, will be made to British, B.O.A.C., Air France and Sabena.

707s are also in production for Air India, Cubana, Lufthansa, South African Airways and Yang. In addition,



720s are in order for American, Elcanal and Irish airlines. Since going into service last October, the 707 has attracted the highest load-factors of any airliner in aviation history. These range from 90 to 95% and indicate the unparalleled profit potential of Boeing jetliners.

Currently, 707s are carrying more than 3500 passengers a day. Already more than 300,000 air travelers have flown aboard the 707.

Boeing jetliners now in scheduled service are demonstrating tremendous earning power, extremely high initial utilization and unsurpassed public acceptance.

BOEING 707 and 720

Airlines List Objections to Fare Proposal

By Robert H. Cook

Washington—Airlines attorneys are regrouping their tactical arguments to contest a recent Civil Aeronautics Board (CAB) decision on the General Passenger Fare Case.

Opposing a larger fare increase than recommended based upon a "new estimate" method of computation, eight airlines have filed comments to the initial decision of Executive Ralph E. Wenz who called for a 12% fare increase to be computed on a rate of return on investment formula (AW June 1, p. 35).

Major areas of objection voiced by the carriers are:

- Suggested 12% increase above that in effect prior to Feb. 30, 1958, will not cover planned operational expansion.

In general, the airlines reported their demands for fare increases ranging from 11.5 to 16%.

- Rate of return formula accounted for 18.15% for American, Eastern, Trans World and United and 11.25% for the remaining eight trunk carriers was applied by most of the airlines who say the suggested percentage should be at least 14%.

Basic value arguments advanced is that the formula is simply a "homemade yardstick" historically with low capital turnover.

- Depreciation policy recommended does not recognize potential service life of existing aircraft. Many carriers note the recommendation as a rejection of a CAB endorsed depreciation policy also effect in 1957 but defeated in court action by the airlines the following year. While the carriers would still follow their own depreciation formula, the plan suggests, is the company would plan a far more in the final determination of rate of return, airline attorneys said.

- Rapid increase in cost of labor and materials may reduce Wenz's prediction that new flight equipment will result in greater engine productivity measured in terms of available ton-miles per engine.

- Charge the recommended fare levels were placed in effect, it would be competitively unattractive for new airlines (raising less than a far return to its higher fuel charges as suggested by the carrier).

Northwest Airlines was among the most outspoken critics of the basic rate's use of return plan which it termed "unfair and a basic flight with costs." A majority supporter of an operating margin formula, the airline criticized the complexity of the recommended formula.

American and United, however, voiced tentative approval of a rate of return based upon investment, with American stipulating that the formula also should be designed to avoid reducing the 720 airline's weight on revenues. Both reported the per centage rate recommended as too low and called for at least 15%.

Strong protests were filed by most carriers against Wenz's depreciation policy which would phase a complete depreciation on piston aircraft and engines and a 15-year life on turbo-prop and turbo-jet engines, with a five-year service life for turbine engines. Wenz further recommended a 17% avoided value for all flight equipment except turbine engines which would have a zero residual value.

Estimated Loss

In earlier objections filed by American in opposition to CAB's endorsed depreciation policy in 1957 and 1958, the carrier said it would have lost an estimated \$30.5 million on its Douglas DC-7 fleet purchased since 1936 and to be fully depreciated by 1961 as a common retirement date. Refuting the charge that the company's own depreciation schedule will result in a residual value of \$11.2 million by the end of 1961, the airline said:

Delts also complained of the 55-year service life on piston planes and cited its fleet of Lockheed L-104 Constellation offered for sale since 1957 with no prospective buyers. The ex-

pire said it placed a three-year depreciation period on these planes. Capital also took issue with the point questioning the validity of the carrier's depreciation policy in view of its fleet of Lockheed Constellation airplanes and the many new aircraft now entering the market.

ATA Stood

The Air Transport Association, which said it opposed the airline decision as "disappointing," warned that any CAB move to establish depreciation policy could hamper the ability of the airlines to adapt to any equipment development in the future. In testimony before ATA said, any other than expected development of supersonic transports could seriously affect a rapidly expanding depreciation policy.

Delts also raised the question of how much benefit would accrue to travelers under the minimum a plan to add \$1 to each ticket. Most of this cost, Delts said, would have a greater impact on short-haul carriers although local service airlines are not a part of the case. Delts estimated that 40% of its passenger mile accounting is run at that the recharge would be split between two airlines. Such a procedure, it said, would result in the airline collecting only 70 cents more per ticket. In addition, the carrier voiced concern that more local service airlines might not improve the 51 airlines, thus forcing Delts to take the same action in a competitive manner.

ATA Complains to CAB

Washington—Air Transport Association complained to the Civil Aeronautics Board last week that CAB investigation on airline pricing seems to contradict points in case in which ATA and the Board still are at loggerheads.

At the same time, ATA explained the Board that it cannot comply with a CAB request for 1960 ATA documents which the department contains on the legal property of its airlines alone. The Board had requested the papers to aid in its investigation into the scope of ATA's activities (AW May 26, p. 42).

In a letter to CAB Chairman James E. Davis, ATA pointed out that two of four CAB attorneys representing ATA in the Air Tariff case, one of them, Mr. J. H. Tamm, is still pending. The association advised Davis that it has no objection to doing work external to the Board has objected on the grounds that it should not be made available to the CAB nor noted also a Board decision on the case has become final.

Replying to a CAB request that ATA decide whether to withhold the contents of 1960 documents in legal proceedings outside the association said Davis that the choice would first be up to ATA attorneys. At a second issue, ATA and the documents in question on the property of its individual airline clients who have been informed of the CAB request. The association said it would make its own determination of which documents involving ATA affairs are protected. ATA also noted that Board investigating how new carriers 1960-69 ATA documents with 1,330,000 cases according to be examined. Setting aside the few documents, under Interstate legal conventions, has had little effect on the maps of the investigation's task, ATA said.



CONTINENTAL'S

VISCOUNT NET PROFIT \$1.3 MILLION IN FIRST 7 MONTHS!

With an average fleet of nine* new Viscount 600 (Viscount II) jets, Continental Airlines recently reported a net profit of \$1.3 million. Over cost per plane mile was 79.35 cents—only 11 cents below budget. These figures confirm those for the first four months of Viscount operation which showed that, with a break-even load factor of only 37.5%, the Viscount was easily the most economical to operate of Continental's aircraft.

Mr. Robert Sta, President of Continental, paid tribute to the Viscount's major contribution as the airline's \$1 million operating profit for the fourth quarter of 1968. And he looks forward to 1969 as "the best year in the airline's 25-year history."

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The popularity of Continental's Viscounts played a leading part in boosting the airline's 1968 boarding 99% in Chicago and 67% in Los Angeles.

Mr. Sta has high praise for the Viscount. He reports that "Performance, passenger appeal and economy of the Viscount II have exceeded all expectations. The public has shown great response. The Viscount II is ideally suited for medium length distances and offers here a great advantage for its handling qualities."

For further information on the Viscount, invite new Viscount II, contact Christopher Chislow, U.S. representative, 10 Rockefeller Plaza, New York 20, N. Y.

*Continental's Viscount II fleet average one mile for the 100th payload within 100 lbs. And, delivery of the airline's total order of 50 new Viscounts is now complete.

Reliability Survey of KC-135 Aids 707

Washington—Detailed operational studies of the Air Force KC-135 jet tanker are being used by Boeing Aerospace Co. to increase the reliability factor of its 707 jet transports.

Information compiled from an 18-month survey of the military aircraft *fleetwide* has proved to be of value to many airline operators who are seeking a significant percentage increase in their production of completed flights as a result of Boeing's intensified reliability program.

Application of the manufacturer's study was evident from a theoretical analysis of the life expectancy and failure rate of all components on the KC-135 and its comparison with a practical study of the actual component failure rate on 15 of the military aircraft at four Air Force bases within the U. S.

Results for both military and commercial models of the four-turboprop have been broken down into sub-components, ordered by decreasing duty-requiring machines and pinned to its Boeing capacities the Air Force and commercial uses of the jet.

Preparation of the Boeing reliability study is to assist in a method whereby it can accurately design and manufacture its aircraft and parts with a degree of accurate reliability in order to allow a responsible prediction of the percentage chance of completing a mission, whether based upon the base length of the flight.

With some variations to allow for different operating procedures, the formulas are being applied to commercial use.

Key to Formula

Key to the formula centers around known component failure rates. This allows Boeing to suggest several other values whereby the flight, whether at commercial use will be reduced by either improving design of existing parts or adding components in new components to cut the mathematical changes of an in-flight failure which would force a maintenance.

More than 2,000 maintenance reports on 35 KC-135s were collected during the study period, according to Boeing. Monthly reports covered 4,000 aircraft hours and flight hours per plane. The information, along with reports from military operators of the 707, is passed on to management, translated into computer code and used as a basis for further research and design by Boeing engineers.

The reports for each malfunction, as to the designated component, number of flight hours, maintenance time to

correct, and conditions under which the malfunction occurred. In this system of three and double check, both in theory and actual practice, Boeing feels it has arrived at a means of controlling the reliability through built into its aircraft. Information is not only of cost value but is expected to be used in future aircraft designs which may incorporate a number of components now being used on the KC-135 and the 707.

Reliability predictions being made on the jet include an average increased average of a typical 6-hr mission, with a detailed breakdown of expected component failure between failures.

The prediction is designed to increase better than a 95% compliance factor, depending upon the flight conditions.

Applying Formula

Application of the manufacturer's formula for commercial flights has been contained previously upon economy of operation.

As an example, the company cites a study of grosser costs and be the Air Force on the KC-135. Thirty of these had a total of 176,392 flight hours and 55 failures which was translated into 0.367 failures per 1,000 hr. of operation. In each case, means to that point and other components mentioned

to 516,806. In comparison, an airline using loss of the same parameters on a 707 reported five failures in 10,016 nonoperational flight hours. Such application of the Boeing formula to the carrier's operational use results in the satisfaction of annual downtime at technical personnel further changes to other parts and allowing the airline a total saving of \$50,000 according to Boeing.

The one change also brought the carrier's failure rate for this comparison up to 9,000 flight hours between failures.

Ground Service

In a similar manner, KC-135 information from the Air Force has enabled airlines to reduce further savings in ground planning for ground servicing on the 707. Comparing the advantages of fuel-air stations against electrical ground carts for the commercial jet, Boeing found the latter system would require 15 failures out of over 1,000 starts while the one system would have 71, or that there was little difference between them for service reliability.

However, in exploring the problem further, they concluded the self-contained units would require less time in much maintenance and have the disadvantage of adding extra weight to the aircraft.



Boeing 720 Built for United Air Lines

First major installation on Boeing 707-320 turboprop to equip transport built for United Air Lines is under way at Boeing Aerospace Co.'s Renton, Wash., plant. Final production there has been moved from Seattle jet. United has purchased seven additional Boeing 720s, making total Boeing transport sales to 15 (AW June 3, p. 32).



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TWA
TRANS WORLD AIRLINES

Airline Traffic—April, 1959

	Domestic Passenger	Foreign Passenger (2011)	Load Factor %	3-5 Mail	Domestic Freight	Foreign Freight	Total Domestic Ton-Miles	% Domestic Ton-Miles
DOMESTIC TRAFFIC								
American	441,450	445,074	70.4	1,446,770	102,338	7,712,844	83,481,149	80.1
East W.	79,777	72,324	69.7	230,750	18,736	889,716	6,341,416	60.1
Capital	226,211	143,830	65.6	331,403	317,204	283,731	14,740,389	70.1
Continental	77,244	34,994	49.2	158,054	16,370	122,144	2,682,182	59.2
Delta	205,710	191,919	94.7	429,420	227,158	1,461,814	14,444,768	90.8
Eastern	737,877	394,161	52.1	986,043	446,471	1,204,810	69,791,176	80.14
Midwest	142,171	70,121	49.7	214,381	46,111	402,802	16,176,099	60.9
Norfolk	146,744	46,344	36.4	100,126	16,704	108,830	4,074,054	60.8
Norfolk	142,343	101,844	71.7	311,246	344,273	344,001	10,844,794	60.6
North W.	204,814	87,219	42.7	315,800	176,807	2,117,799	16,176,099	60.9
South	261,202	179,342	68.3	2,276,787	112,200	4,128,632	16,437,126	60.6
Western	110,762	65,451	57.4	341,156	37,247	326,343	6,496,382	59.6
INTERNATIONAL								
American	8,214	8,222	34.1	8,710	464	226,454	1,787,738	34.2
East W.	2,371	8,221	42.7	14,706	118,268	876,142	44,671	64.7
Continental	87,411	2,694	66.5	1,440	7,761	201,146	29,146	69.6
Delta	2,308	4,421	59.7	7,464	45,564	561,794	44,671	64.7
Eastern	22,630	46,412	67.7	79,337	124,464	3,127,807	44,671	64.7
Midwest	11,640	2,344	40.7	7,127	1,127	268,737	44,671	64.7
Norfolk	2,304	8,347	64.8	8,362	4,443	861,944	44,671	64.7
Northwest	12,030	24,234	59.3	1,013,716	17,779	1,704,446	4,172,838	60.1
South	2,844	2,467	66.4	30,127	140,477	430,172	44,671	64.7
Western	100,426	127,343	64.9	1,440,412	9,447,447	17,444,447	44,671	64.7
East W.	19,404	104,347	69.7	1,440,412	14,444,447	17,444,447	44,671	64.7
Delta	12,408	101,219	79.3	1,012,219	2,176,216	14,444,447	44,671	64.7
Eastern	10,728	14,283	16.3	70,257	331,114	3,176,104	44,671	64.7
Midwest	2,377	97,203	78.4	107,229	1,012,121	11,017,201	44,671	64.7
North W.	146	49	20.4	49	49	2,791	44,671	64.7
South	1,024	19,404	45.8	127,331	10,146	4,276,468	44,671	64.7
Western	1,146	8,289	58.3	15,788	31,440	387,473	44,671	64.7
LOCAL SERVICE								
Allegiance	47,449	7,704	16.9	11,777	20,381	31,147	734,704	44.6
American	19,716	4,441	26.6	6,709	2,444	4,441	479,476	57.6
Continental	10,140	2,479	10.9	2,754	1,444	275,444	30,140	30.2
Delta	29,116	2,400	7.9	22,294	7,444	107,344	44,671	64.7
Eastern	18,400	2,476	10.6	4,424	14,444	14,444	381,447	44.6
Midwest	44,412	1,476	3.3	14,444	14,444	14,444	44,671	64.7
North W.	70,441	19,441	25.7	31,446	27,243	37,243	1,234,556	44.6
South	49,116	8,227	16.7	11,411	22,227	20,338	944,497	42.1
East W.	14,142	7,700	13.2	2,442	5,441	6,441	744,341	61.9
Midwest	46,407	2,127	4.7	7,116	11,444	14,441	100,447	41.4
South	21,444	2,119	9.7	7,112	7,112	12,333	401,444	39.7
West Coast	33,714	4,441	10.9	14,239	2,700	30,347	171,333	41.4
West Coast	31,112	2,074	6.4	3,910	7,717	8,313	101,444	44.6
WEEKDAY								
American	17,490	2,214	10.4	1,427	2,740	182,314	24,2	24.2
Continental	24,721	1,142	4.3	1,222	114,924	526,141	44.2	44.2
CARGO LINES								
American	4,140	4,140	100.0	11,770	3,770,104	8,016,324	72.0	72.0
Continental	3,781	19,429	188.0	36,140	36,727	408,870	80,870	82.7
Delta	3,781	19,429	188.0	36,140	36,727	408,870	80,870	82.7
Eastern	3,781	19,429	188.0	36,140	36,727	408,870	80,870	82.7
Midwest	3,781	19,429	188.0	36,140	36,727	408,870	80,870	82.7
North W.	3,781	19,429	188.0	36,140	36,727	408,870	80,870	82.7
South	3,781	19,429	188.0	36,140	36,727	408,870	80,870	82.7
East W.	3,781	19,429	188.0	36,140	36,727	408,870	80,870	82.7
Western	3,781	19,429	188.0	36,140	36,727	408,870	80,870	82.7
MILCOPIE LINE								
Chicago to Memphis	11,140	11,140	100.0	1,140	1,140	1,140	26,194	26.1
Los Angeles to Memphis	1,771	11,140	36.4	6,731	2,420	2,420	12,294	41.8
New York to Memphis	1,771	11,140	36.4	1,771	1,771	1,771	11,440	41.8
ALASKA LINE								
Alaska Airlines	9,171	8,091	88.1	47,222	2,441	102,141	4,036,162	55.4
Alaska Coastal	2,408	4,441	18.4	4,441	4,441	4,441	44,441	44.4
Continental	4,441	4,441	100.0	4,441	4,441	4,441	44,441	44.4
Delta	4,441	4,441	100.0	4,441	4,441	4,441	44,441	44.4
Midwest	4,441	4,441	100.0	4,441	4,441	4,441	44,441	44.4
North W.	4,441	4,441	100.0	4,441	4,441	4,441	44,441	44.4
South	4,441	4,441	100.0	4,441	4,441	4,441	44,441	44.4
East W.	4,441	4,441	100.0	4,441	4,441	4,441	44,441	44.4
Western	4,441	4,441	100.0	4,441	4,441	4,441	44,441	44.4

* Not available.

Compiled by HAWAIIAN WEEK from airline reports to the Civil Aeronautics Board.



Aeroflot, the Soviet state-owned airline, has started Il-18 helicopter transport service between Moscow and Adler on a three-hour nonstop schedule. Aircraft is shown at Adler on May 4 helicopter in Aeroflot markings (top) leaves for scheduled service between Adler and Sochi, on the Black Sea (A.V. Mo. 5, p. 10). At bottom, Il-18 undergoes a maintenance check, with track and the towing.

Aeroflot Begins Il-18 Service Between Moscow, Adler



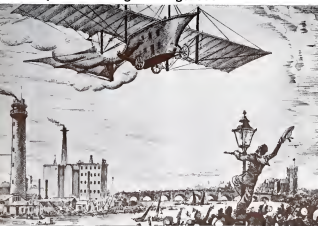
Il-18 cockpit arrangement (left) shows: (1) co-pilot's seat; (2) driver and co-pilot's seats; (3) radio operator; (4) radio; (5) radio operator; (6) instrument; (7) control panel; (8) control panel; (9) control panel; (10) control panel; (11) control panel; (12) power supply distribution; (13) instrument panel; (14) pilot's seat; (15) control panel; (16) control panel; (17) nose gear; (18) right instrument; (19) radio scope. Scope is not installed in cockpit at right.



Flaps down and right also start low, Il-18 overboard engines to test to camp at Moscow's Vnukovo Airport. Nose of another Il-18 is in foreground, with weather radar and navigation. Engines behind indicate an airplane. Engines, starboard and right check gauges taken during loading. Ramp is hydraulic, self-propelled unit, indicates trend toward more modern Aeroflot ground handling equipment.



Propulsion through the ages...



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An outstanding proposal. In 1947, William Samuel Horman and John Bergsma collaborated on the design of the 'Aqual' and produced a model. A steam engine was designed to drive two propellers by means of cords from a large crankshaft pulley. Experiments in Gloucestershire confirmed good work. Assisted by interested students and heavy staff the attorneys accepted eight trials, only to be dissuaded when the officer

wings. More recently in Glendale, where Rotol is located, Rotol designed, developed and produced the propellers for the first turbo-prop aircraft (1943). Since then, Rotol has supplied turbo-prop to more than 100 airlines and aircraft operators throughout the world who attest to Rotol reliability. Rotol propellers are standard equipment on the Vickers Viscount, Fokker F27, Cessna 441, Cessna and Piper Bonanzas.

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000000 Hubs towing a Cheng helicopter away. Shows S.H. bomb fragments at the Wounded. F. helport for flight to Clinton's airport in direction. At night a the frequent summer south. Wounded. O'Hare, Midway, the Loop and Gary.



Chicago Helicopter Buys Turbine S-61s

Midway Airport, Chicago-Chicago
Helicopter Airways is announcing today that it has signed an agreement with Sikorsky Aircraft Division of United Aircraft Corp. for the purchase of three turbine-powered S-63 helicopters.

The order, first produced by *Aerurus Wana* (JAW Inc.), p. 51), was for delivery of the three-engine aircraft in early 1961. The 15-passenger helicopter was chosen by the Chicago carrier as the aircraft "best to CHS's future look" after long studies and surveys of equipment available in today's markets and on the domestic scene.

Primarily, the fleet, which was increased to a total of five, is designed to absorb Chicago's rapidly expanding traffic second-to-none (and fast increasing) suburbanites the company in the fastest growing suburb in the U.S. A fleet of five Sails will produce three and one-half times the number of car-miles the current obtains from its present fleet of five 12 passenger Schoolbuses 5-10 locations.

Once the S-Bs are fully integrated into Chicago's interairport and urban bus schedule patterns, the carrier will gradually phase out its S-Bs to make the company an all-diesel-powered

helicopter operation. The extra capacity of the S60s not only will help it to cope with the rising traffic demand but will permit further route expansion to suburban areas and cut cost and time per cost of the operation.

Maintenance Plan

The 5-61 is powered by three General Electric T58-6 gas turbine engines. Engine overhaul and maintenance plans have not been final, agreed by CIMA. It has been decided, however, that most overhaul of the engines will be handled by General Electric. The amount of maintenance work it will undertake will be determined after further negotiations between the two companies.

Chicago will do all structural overhaul and maintenance and probably will handle all engine line maintenance. Company mechanics will be trained in General Electric and Sikorsky. A T-56 engine has been out of order in the past.

Financial arrangements covering the purchase are still in the discussion stage between Salomon and Chicago.

Chicago Helicopters officials are confident that the introduction of the S-40 will pose no new problems but, conversely, will improve operating efficiency—a factor that has contributed heavily to the company's record of achievement thus far.

For example, average speed of the S-18 has been lifted from an average 75 mph in mid-1957 to 88 mph in May to permit a substantial increase in daily scheduled miles. The S-61 will have a rated speed of 150 mph.

C. W. Moore, executive vice president, told *Airways* there that the average speed boost of the SIDs has been accomplished, not by accelerating throttle speed but by improving pilot performance, eliminating distractions and saving fuel more efficient air traffic control procedures in cooperation with Chicago tower controllers at Meigs, O'Hare and Midway, the three airports served by Chicago as its remote service.

In this connection, John S. Glavin, Chicago Helicopter accident, points to the military safety record as strong testimony to the "dependability of scheduled helicopter operations." CHA has operated five million miles over a period of 10 years without an accident.



FRENCH AIRLINE LAUNCHES FIRST FAR EAST SERVICE!

CAPTAIN M. NOGUES COMPLETES FIRST SCHEDULED FLIGHT BETWEEN NANTES, SAOIGUÉ

Nantes, France, February 25, 1960—Captain Maurice Nogues landed his Convair 440-1 today after completing the first scheduled transatlantic flight between Nantes and Saigon, Indo-China. Captain Nogues' exploit marked the beginning of the new era of international flights along the route. The service is expected to speed mail, cargo and passengers between Europe and Indo-China.



Nogues' flight

FIRST IN INTERNATIONAL AIR TRAVEL! Since the very beginning of aviation history, men like Diderot, Bonaparte and Nogues have led the way in international flight. Today Air France continues this tradition of leadership in air transport by offering the most non-stop flights both ways between New York and Paris and the fastest jet service in Europe and the Middle East. Next year Air France plans to cover the world's largest route network with one of the largest fleets of jet aircraft in the world.



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on passenger revenue. That six-month period's checks call for substantial savings with a dead engine.

Despite the fact that CHA's operations are always under VFR conditions during the period from 6 a. m. to 11 p. m. when it conducts its scheduled service, the airline in April completed 97.9% of scheduled flights. It runs some a high in time performance because its flight traffic patterns are directed from load wing traffic patterns and long hold periods are seldom experienced.

Traffic procedures permit CHA to run routes in as fast as 300 h. air time. In airport control areas, CHA maintains a 500 ft. altitude and generally conducts on route operations at 1,100 ft. Routes over Chicago run in south from a quarter mile to a half mile.

Two route turn arounds have been made possible by efficient loading and unloading procedures. Routes are not shut down at intermediate stops so that no time is lost in scattering operations.

The S-61 is designed to fit within CHA's operating policy. Space will be provided under seats in also a more spacious use of cabin as baggage than that now possible with the smaller S-55. Overhead bins will be installed for kits and coats. Passenger door will open down into a stairway so that a loading ramp of steps will not be necessary.

Test Flights

The S-61, which is scheduled for test flights in mid 1960, has a three hour full construction (AVL 27, 140). The aircraft will be equipped with a retractable landing gear and retractable landing gear. It will have a four-bladed main rotor and four-bladed tail rotor.

Operating efficiency of CHA's scheduled flight operations. For example during the month of May, the airline carried a record 17,146 passengers. And a large percentage of these passengers were here due to a combination of all eight passenger aircraft of over 2,000 reservations per agent.

Such efficiency permits a wide range of operations of other vehicles to meet sudden demands for seats that otherwise cannot be accurately anticipated as far as efficiency in a traditional test regime, such as can be planned. On May 8 the airline handled 300 passengers a record for daily operations through the introduction of other sections of peak periods.

During one hour of the day, CHA, Model 94 of the 96 seats offered on night flights operated on the airport traffic route. Load factor for the day on the Chicago-Milwaukee route reached 57% between load factor passed 60%.

The carrier recorded a load factor of

32% for the month of May, a sharp drop from the 79% load factor reached in March. CHA blocks off no load such as flying load factors and uses the total capacity of 12 seats in the S-16 in completing available seat miles. In addition, the recent load factor which was accomplished in the face of an additional five round trips usage added on the airport traffic route in April. More more round trips will be added to the route in July.

Passenger traffic goal for the revenue this year is 158,475 passengers, which, if achieved, would represent a 40% increase over the 106,000 passengers carried last year. More has no doubt that his target will be reached. In fact he now feels that he was late in the flight too low and that CHA may be on all time record of 167,000 passengers by the end of the year. The airline stands at handling a traffic volume in excess of 45% over the number of passengers carried through May, 1959.

CHA operates seven daily flights to Milwaukee, a weekly service on Chicago's northern shore. Six flights daily are operated to the national headquarters of Gary, Ind., south of Chicago. More route, however, is the 42-in. triangle route serving Chicago on the Loop shore. CHA's Chicago's get airport on the northwestern side and Midway on Chicago's southwestern side. CHA also operates three Bell 47G helicopters on a base route serving 50 suburban communities.

Delay in Plans

The traffic demands of the triangle route have delayed the carrier from expanding its passenger service to other bus routes as originally planned. In addition, More points out that the airport route now offers the company's "biggest potential."

Civil Aeronautics Board is now investigating the feasibility of permitting transients to serve both CHA and Midway on the same flight following its



SIKORSKY S-54 helicopter is parked near Trans World Airlines Boeing 707 at O'Hare Field above. Below, Chicago Helicopter Airways' new Sikorsky S-54s are shown.



AIRLINE OBSERVER

►When Veeva's 74D series aircraft are undergoing a close inspection on flap and aileron clearance under a new Federal Aviation Agency airworthiness directive. The agency says inadequate clearance between the end of No. 3 flap and the aileron has often resulted in an unsafe condition when flap failed to retract to the stowed end of the aileron. Inspections were ordered completed no later than June 15. Whenever a tip of less than 0.15 in. is found to exist, the outboard end of No. 3 flap must be modified to provide proper clearance, a change considered mandatory by the British Air Registration Board, according to FAA.

►Flight Engineers International Asia hopes to end the aid of the Society of Automotive Engineers' Committee on Cockpit Standardization to spell out the duties of flight engineers as a means of settling the current disagreement among the Air Line Pilots Assn., several manufacturers and airlines. Crew complement issues have created confusion in cockpit seating, particularly with the placement of a third pilot on the new jet aircraft. The engineers stress controls that effects to save the third pilot are displaying FEIA members from their own aircraft positions at the expense of safety and economy of operation. Engineers will present SAE with a comprehensive review of flight engineer duties highlighting statistics on both pilots and turbine-powered aircraft operational problems handled by FEIA members.

►Northwest Airlines' single factor tariff for air cargo has failed to escape from the first quarter of 1958. The air truck plan, which now involves 12 loading times at typical rates of 2,200 air miles left to the other side of the coast's waters. Even an average increase to 790 tons monthly, the plan now covers 5,000 in 23 states.

►Boeing has inaugurated its first regional jet passenger service to the Far East. Two 40s were placed on the Vancouver-Petrogradsk, Khabarovsk, route on May 15. Flight time is reportedly down 40% as compared with five days by steamer.

►Federal Aviation Agency is soliciting bids for a two-year weather study expected to produce a complete forecast for airlines weather problems for the next 15 years. Giving a need for greater accuracy suggested by such advances in planned supersonic transport, FAA's long range research is part of a joint program now being organized by the agency with the military services and the U.S. Weather Bureau. Particular emphasis will be placed upon detailed data collection to provide precise weather for traffic control computers now being installed by FAA. Computers have been commissioned for their use at Cleveland International Airport and Washington National Airport. In late summer, additional research will be initiated at ARTC centers in Pittsburgh, Cleveland and Boston according to FAA.

►Passenger traffic change on the Pacific airline LOT last year was more severe than the current had anticipated when it would have in November, 1957. The ground-owned airline, which handled 225,000 passengers in 1957, estimated it would handle 60,000 fewer in 1958. But the total dropped by 80,000 to approximately 145,000 passengers.

►North Central Airlines credits its Convair 440 service for much of the 17% increase in revenue passengers carried last month. During the last full month of Convair operations, the airline carried 35,745 passengers to set a new monthly record for the local airline industry.

►Military Air Transport Service says it has the answer to the costlier problem of air mail business to give commercial carriers without sacrificing its own operational strength. Lt. Gen. William H. Tunney, commander of MATS, points out that the Air Force moves 99% of its officers, airmen and their families overseas on military and commercial flights. If the other two services moved a comparable percentage by air, Gen. Tunney says it would increase MATS' revenues by almost 99% and the best of the volume of commercial traffic.

application for such service by Continental Air Lines. However, it is not likely that the agency will be approved because of the traffic density implied in such service.

As a result, CAA holds a strong position in the link between these two airports which are at least two hours apart by ground transportation during rush hours.

Increased traffic in Q-Hair is raising benefits for CAA, an indication that the helicopter has not been forced to cut time in concentration in the immediate market. In April, the first full month of highest service at Q-Hair, CAA carried about 2,000 passengers using the helicopter facilities. This total climbed to an estimated 5,000 passengers in May and, as more military service is introduced during the year, the traffic demands made on CAA is expected to increase accordingly.

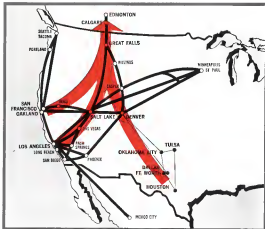
SHORTLINES

►American Airlines, with a super record from the introduction of turboprop and turboprop aircraft, reports another increase during May over comparable figures for last year. The carrier says its 1,250,000 freight ton miles figure establishes an industry record for the month and represents an increase of 11.5% over its May, 1957, figure. Other related figures are revenue passenger miles, 473 million, up 11.6%; aircraft miles, 218,000 ton miles, up 14.6%; and, 1,610,000 ton miles, up 14.5%; revenue, 506,000 ton miles up 7.7%.

►British Overseas Airways Corp. is doubling the size of its destination London terminal at a cost of \$2.5 million. The eight-story, block-long building will be 16 ft. high and its length is scheduled to 170 ft. Expansion will provide for the handling of some 1,000 passengers an hour. First stage of the work, including a restaurant, is scheduled to be completed within a year.

►Holland Airlines has purchased an additional four Convair 440s, bringing the number of Convair aircraft in the airline to eight. Purchase was made through William C. World Associates and cost of acquisition and related equipment was approximately \$14 million. Two of the aircraft came from KLM Royal Dutch Airlines, one from Aerotrans and the fourth from National Airlines.

►Northwest Airlines reports an April net income of \$234,320, a gain of 182.2% over April, 1957. The carrier showed a 34% increase in passenger revenue at \$7,725,504 and operating revenue of \$9,681,928 for an increase of 31.5% over last year.



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Now Western Airlines has direct 4-engine service to Calgary/Banff and Edmonton—from Los Angeles, San Francisco, Salt Lake, and Denver! No more layovers, no more airline-changing. Your modern DC-6B airliner takes you directly to Calgary and Edmonton Airports! Here's the instant air service over to Alberta from major cities of the West. Faster and most direct, too, from Oklahoma and Texas cities—with connecting service from Denver. For business travel to Canada's oil and ranch country...or for vacation travel to Canada's spectacular national parks...Western's the wonderful way to fly!

**WESTERN
AIRLINES**



Bloodhounds ready for launching during acceptance trials at Warton

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EFFECTIVE DEFENCE

More advanced Bloodhound for defence of UK confirms particular suitability for European defence needs

Already in operational service with the RAF and adopted by non-NATO Sweden, Bloodhound Guided Weapon System is now to be further developed for the RAF.

This developed Bloodhound possesses substantially increased operating range and altitude, with advanced technology ensuring still greater lethality as these increased ranges and heights. Low altitude performance is further improved to counteract the threat of low-flying targets.

Development, rather than replacement, of Bloodhound

offers the obvious economic and operational advantages inherent in making use of an existing system.

Proved in many hundreds of test flights, built by Britain's largest missile manufacturing company, and particularly suited to European defence needs, Bristol Ferranti Bloodhound forms the world's most effective defence system around for many years to come.

Recently British publication of full details, but the following facts at least Bloodhound can now be given—

Power The Bloodhound is powered by two Bristol Siddeley engines—jet engines with no moving parts. Engines ensure power and range flexibility, have low noise, are simple and safe to handle.

Tracking System. Some-arc—i.e., ground area directly under nose—is 14 deg, which is reflected too directly as Bloodhound, ensures highest accuracy—regardless of range. Missiles may be fired, singly or in salvoes, using only one radar.

Airframe. Easyjet wings and advanced monoplanes moving wing configuration—two advantages—quicker and more precise response, as well as greater accuracy of

interception, superior at high altitudes. This configuration was selected at initial design stage to embody maximum development potential.



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TARGET ILLUMINATING RADAR BY RTH—SYSTEM SALES ORGANISATION BY BRISTOL AIRCRAFT LIMITED



FIRST Lockheed C-130A three-engine aircraft takes off from Robins AFB, Ga. These aircraft families and models from Ryan Probus (top) alone \$1,000 ft. (Bottom) are mounted on piston motor wing.

Lockheed Pushes European C-130 Plan

By David A. Anderson

First—Lockheed Aircraft Corp.'s Georgia Division is pushing hard to sell a new aircraft for production of the Hercules C-130A triprop transport in Europe.

The triprop transport is featured here at the Rome International Aero-nautica as part of the company's sale drive. Two C-130As in service with the USAF's 322nd Tactical Carrier Wing at Fort Benning, Ga., are shown, along with a C-130A in flight. The aircraft, plus company performance highlights and details.

A large portion of the Lockheed state-ship is also directed to the Hercules. The Hercules is now in production for the USAF and other customers, have been making the aircraft recently in Europe. American Wings has been making the aircraft recently in Europe. American Wings has been making the aircraft recently in Europe.

Lockheed Proposal

Strategic arguments in the Lockheed proposal are these:
 • Logistics transport could be in Europe.

years service in two-year time after reaching agreement.

• All production will be European, with the exception of a few spare parts which will be shipped as logistics.

• Five years of development time and \$100 million could be saved, compared with development of a new transport in Europe, under the current, according to a Lockheed analysis.

• Major savings would also be realized compared with outright purchase of the aircraft from the United States, if more than a couple of dozen were purchased.

In its present form, the Hercules seems to exceed most known military aircraft requirements originating in Europe.

Good Record

The plane has racked up a good record with the USAF all over the world, including service during the Lebanon crisis. Its safety record has been outstanding. It has had fewer accidents than any other military aircraft accepted by the USAF for squad use.

European needs for logistics transport are growing rapidly. The home fact is that the USAF might not be able to export North Atlantic Treaty Organization (NATO) requirements in the event of a Western Royal Air Force Transport Command is in a state which has been the subject of great European interest and great concern for years.

and its future is not particularly bright. There would be little R&D strength available for NATO transportation if not come.

Europe's North Atlantic transport is the only relatively modern cargo carrier in service in Europe, although it is also being made to the German. But the bulk of Europe's airlift capability is made up of fleets of bi-engine aircraft, including C-119s and Douglas C-47s, supported by some local types with very limited performance.

Aircraft Estimates

Most European logistics reports estimate the maximum need for NATO at about 100 aircraft in the Hercules category, with 500 units mentioned as a desirable number. These would meet the bulk of these with German and Italy, running in for second-largest backlog.

Lockheed is moving into an area where there is already a large, if nebulous, European effort. The American company will have to fight both politically and technically the market.

France and Germany have been operating with Hercules aircraft, so technical development of a logistics transport is a foregone conclusion with a good weight on the order of 90,000 lb. Design work is believed to be under way by now at West Flugzeugbau in Bremen, Roll-Reiner Tripropeller engine have been specified in the proposal.

Lockheed experts who are working in this matter have criticized the West design as being an attempt to build a two-engine Hercules 14 years later. They point out that even with the most optimistic view of costs, the plane could not possibly be in squadron service in less than five years, and that even with the best case would be in the right margin. In that case, they argue, the design would be obsolete.

National Problem

Major problem plaguing earlier attempts to obtain European aid for the Hercules has been a national one. Each country wants to get its rightful share of the total order, even if it means waiting up parallel production lines at greatly increased unit costs.

One close example was the offshore procurement program for the Hawker Hunter. The plane was in full production in Britain but parallel production lines were set up in both Holland and Belgium. Unit cost figures have never been released, but it is obvious that the British and Dutch Hunters cost more than those delivered to the Royal Air Force.

Production of NATO's lightweight strike fighter was planned as a competitive venture, each country adopting the plane, without the backing. Whether the plan was successful or not.

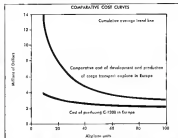
led production lines or single source production with design subcontracting is not known. Now, both plans have been abandoned, and the C-130 is being built in Italy for the Italian, other customers and the German, while the German are setting up their own production for the plane.

In contrast, production of the European Hercules is tied to the actual requirements of any particular country for the plane.

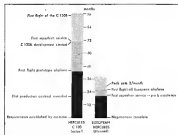
Thus if France needed 100 airplanes, or about one-third of the estimated

total needs of Europe, French industry would get one-third of the job. It might be under such conditions, construction and final assembly, which are totals about 50% of the three-hour effort on the Hercules. But the French would do that job for the entire run of 500 airplanes and not get for the 104 they needed.

This would make the unit cost of the component the lowest possible, because it would be spread over the entire production run of 500 airplanes. This is clearly cheaper than buying the



LOCKHEED chart projects comparison of costs to produce the C-130 in Europe against cost of development and production of a single transport aircraft in Europe.



EUROPEAN BUILT Hercules could make a peak production rate of three per month within a 25 month period after completion of negotiations, according to the company.



SUPER HERCULES version of the Lockheed C-130 triprop transport is shown in model form and would be powered by Allison T43 turbo-prop engines developing 5,100 hp each (AW April 20 p. 45). Sketched version is 30 ft. longer than p. 45.

The logistics of LOX



Liquid oxygen is being loaded into these tanks trailer right from an Air Products generating facility ... and in a matter of minutes it will arrive at an adjacent missile test site. This will happen again tomorrow, the next day, next week—whenever LOX is needed. Each time it happens, valuable time will be saved.

The LOX will get to the test site faster too ... because despite government character the possibility of contamination from intermediate tanking and storage.

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hydrogen ... and to argon, acetylene, carbon monoxide and many other vital military and industrial gases. In such cases, the key to dependable supply is Air Products on-site generation to serve the needs of a single customer. There's no "overflow" handling, no waiting in line.

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French-built 100-employee airplane leaving some other countries build it and a third build it?

Lockheed Martin engineers have divided the European Hercules into seven basic packages for production. The hundreds of packages turn out to have two characteristics. First, package "value" ranges between about 5% and 20% of the total man-hour effort. If a country has a small industry and a small requirement, it gets a small package.

Second, the work to be done on a package may be simple standard assembly construction, such as that needed for the engine-geared, or sophisticated mechanical work, such as that needed to produce the engine or the wing outer section. If a country has a specialty in machine work, it gets the engine package.

Price Advantage

With few exceptions, all of the competitors at the European Hercules bid, is built by European industry as it now stands. There might be a price advantage in getting certain loggers cut up, or integrally stiffened panels from the Lockheed line, which costs are far down the learning curve. This is a production detail that could be easily worked out in agreement.

Time saving is justified by comparing the C-130 development program with that of the proposed European Hercules. The first prototype C-130 flew about 43 months after the requirements were established. First production aircraft were delivered 37 months, or six years, after the requirements.

The last flight of an all-European airplane could be made about 26 months after completion of negotiations. The first production could be a European service in about 20 months after negotiations were completed assuming that part of the agreement would include such assistance to Lockheed in the European industry. This cost advantage would be quickly phased out as the European team built up to a typical size of three per month at about 18 months after the completion of negotiations.

Time Cycle
Noback is going to beat that kind of a development time cycle. It is now considered in the world market to produce to design a new military transport. The plane would not be in squadron service for at least five years. Lockheed observers at European meetings are inclined to note that right over now, and on eight years.

The development programs for the C-130A and C-130H models required more than 27 million man-hours of engineering and testing time. These astronomical figures can be compared to what would European industry. Even French-built 100-employee airplane leaving some other countries build it and a third build it?



Two Lockheed C-130 transport aircraft are shown in flight over a body of water. The aircraft are flying in a V-formation, with the lead aircraft slightly higher and further ahead than the second. The background shows a hazy horizon over the water.

a cooperative industry, such as the idealistic plan of the German-Market has declined what would have been the capacity to meet that requirement alone, to us, nothing of handling the other grounds nor either in the world or planned.

If European competitive production were accepted, there would be employment for about 3,000 persons over a several production run for about 100 airplanes.

American Scale

On an American scale, this is relatively small, but in European standards, this is larger than the entire British aircraft industry, or about as large as the entire German aircraft industry. This is substantial employment for Europe, and certainly a heavy factor to weigh in any decision.

Lockheed's contract is not a rigid one. There is nothing to prevent one country alone from taking the entire job of basic production except the very practical factor that only two European countries have industrial capacity in plants and personnel to do the job.

The company has also proposed the modification of Rolls-Royce Turboprop engines replacing the standard Allison T16 engines now in the USAF inventory.

The advantages of a Turboprop Hercules are apparent for their cost, but with the need to live in the present shipping area and might be the reason for weighing a prospective defense solution of the American defense with British powerplants.

The fact that Rolls-Royce is willing to license production of its engines seems promising. This would be no ex-

clusive—also likely weight to the requirements.

There are counter-arguments to the positive one that Lockheed puts forward. One European NATO nation regards the Hercules as entirely too big, and is thinking in terms of a smaller tactical transport. Perhaps the best reason to this is that nobody connected with military transport has ever heard of a case where there was too much capacity in an airplane. Technically, the Hercules is capable of meeting that country's requirements for its island and loading an unpowered strip in a case that situation and then according to a wide margin of other requirements.

European Engineers

Another argument is that the Lockheed proposal doesn't take into account the economy now in European industry. What will be in it for them to stimulate their design thinking? Nothing much, says Lockheed and surely it is an advantage. The technical design teams of Europe can then concentrate on the design and development of new airplanes, second generation fighters or defense missiles, instead of working their time duplicating or trying to hold on as existing designs that is already more than adequate to the needs of Europe for the next decade.

Let the airplane or experience, most countries experience. When costs are high, but no airplane power plant modernized, and no active European development will not come on a next best interest. The risk question is whether or not the aircraft capacity is needed.

If it is, say the company, the European Hercules is the answer.

[illegible]

CHR ANNOUNCES M-777 A NEW HIGH STRENGTH SILICONE RUBBER

185% Stronger Than "High Strength" AMS 3245

M-777 is an exclusive CHR development offering a combination of properties unsurpassed by any other silicone rubber. The new compound has physical strength equal to good general purpose organic rubber and may be used in applications where high tear strength or oxidation resistance is required.

M-777 doubles many of the critical physical properties of AMS 3245. It is unaffected by time, weather, sunlight or ozone—retains flexibility at -300°F—remains tack up to 300°F—and has good electrical insulative qualities. Typical properties are listed below:

M-777 can now be specified for extrusions, moldings, extruded and vulcanized joints or in combination with newly reinforcing fabric or with Teflon® bonded to its surface.



PHYSICAL PROPERTIES				
	In Finished Properties	By Best Facilities April 28 Issue 157 F	Comparison for 70 to 300°F Percent of original retention	Low Temperature Flexibility
M-777	Compression Stress at 50% Elongation 1000 psi Tensile Strength 2000 psi Tear Strength 2000 psi	Compression Stress at 50% Elongation 1000 psi Tensile Strength 2000 psi Tear Strength 2000 psi	45	-120°F
AMS-3245	Compression Stress at 50% Elongation 1000 psi Tensile Strength 2000 psi Tear Strength 2000 psi	Compression Stress at 50% Elongation 1000 psi Tensile Strength 2000 psi Tear Strength 2000 psi	75	-100°F



CHR has made many important contributions to the development of silicone rubber compounds and techniques. The first truly high strength silicone rubber was introduced by CHR.

M-777 with 2100 tensile and over 300 tear strength, and considerably broader the possible range of silicone rubber and adds a new dimension to its many unique advantages. We invite your inquiries.

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FUSELAGE FRONT and double tailplanes are emphasized in this view of the Northrop N-156F jet fighter at its rollout.

N-156F Embodies Frontal Attack Concept

By Richard Sweney

Furthermore, CHR—Protoned, capitalizes of unique monomers to meet effective forward hemispherical attack and basic needs of N-156F weapon system actually rolled out by the North Division of Northrop Corp. (SN June 8, p. 38).

Designed for production and operation by NATO and SEATO nations, many of whose borders form what would be the "front line" in case of an attack, N-156F is shown on these points of small, lightweight, low-cost, Mark 1 F aircraft in six major functions.

Starting from an early morning radar pickup, through assembly of fighters, climb and intercept for a forward hemispherical attack, by missile, the N-156F allows an aircraft to go on about five miles further than would a Mark 2 airplane, all other conditions

being equal, according to N-156F release. Detection was figured at 160 mi. from border, and attack speed was more than Mach 4-5.

Using forward hemispherical attack, the N-156F would stay below the clouds, at lowing the strike to make the climb to intercept, saving time and fuel for additional combat, while making use of the quadrant which gives best return to both lateral and radio for control system.

Transcending reliability and safety, no small matter in the air-to-air open arena of an air force. Separate and dual systems in the aircraft keep one engine from being catastrophic.

Starting from base of refueling light and simple refueling and post-flight, N-156F can accommodate very sophisticated fire control systems and wide variety of external stores should the customer be able to maintain and operate the airplane in these configurations.

In addition, the base refueling post-flight still is available, this early and accurate to load, allowing the customer to get more for his money.

Advance to Mark 2 speed capabilities, a superior with engine engine control now in development.

Performance calculated for N-156F, which N-156F is comparing the plane, with its competitors and in very general estimates, indicates an initial climb rate approximately 25,000 ft/sec at sea level and corresponding climb rate altitude, yielding an overall climb rate to approximately 100,000 ft/sec from lower forward hemispherical attack, at about 2 min. from rollout.

Range, figured on the basis of no external fuel, maximum flight from time of reaching attack altitude until attack completed and advance climb, is approximately 180 mi.

This range would be extended considerably if the normal pattern was



FIGHTER version of the T-38 Falcon trainer, the N-156F is 45 ft. 11 in. long and is equipped with 800-hp engines.

AVIATION WEEK, June 15, 1959

meeting of minds

to find
the means...



Recent contributions of the
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DESIGNATION "Fendoff fighter" the Northrop N-156F will be delivered to USAF squadrons in March, 1983. Aircraft is planned for foreign production under license agreements.

Informed of customer effort slash, high response time to intercept point also achieved as evidenced, thus an attack calculated at Mach 1.4, the N-156F is truck design speed. Minutes can be of course, launched at one speed up to 10,000 ft, however they are executed with a 25 deg nose down attitude in relation to fuselage reference line, to achieve the optimum angle for launch of design speed.

Starting from Mach 0.9 cruise, the N-156F can accelerate to its 3.4 Mach number in about 1 min., the company says.

Offered briefly of a 10 sec. takeoff, all gross weight of 17,130 lb with 100 gal of internal fuel. Subsonic-type airframe enables and the maneuver is required for control system. N-156F engine convertible.

An alternate configuration would have a takeoff gross weight of 15,000 lb, with 1,150 to 1,600 gal of internal fuel, 1,950 lb external fuel (two 130 gal tanks) and 550 lb of airframe and systems on each wing, but on a conventional belly tank, subsonic-type

As a strike reconnaissance aircraft, with a takeoff gross weight of 18,710 lb, the fighter would carry one 2,000 lb bomb on a belly container rack, one 100-gal (975 lb) external fuel tank on a wing pylon, while the opposite wing pylon would carry a 685 lb photo-reconnaissance pod.

Maintenance: protected for the N-156F is pegged at 21 man hours per flight hour, according to Navors, as opposed to the two Mark 2 fighters "X" and "Y" with which the fighter was compared on paper. Arguably X was rated at 46 hr for the while Y was rated at 47 hr for 10 hours on X and Y was claimed. Navors (14) from official information. Navors declared the N-156F figure included all maintenance short of depot.

A large measure of sustainability of the N-156F is the Navors says, in the use of the "service center" concept, plus on maintenance wheels accessories are not mounted on the engine but are coupled to it through a drive shaft and gear box, enabling accessories to be changed without removing the engine.



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"WHERE THERE'S PROGRESS, THERE'S PLEXIGLAS"



SIDELINER Sixty-toy without tracking noses are fed from the wingtip tankers of a Lockheed F-104-9 fighter.

Lockheed Stresses F-104-9 High Speed

Lockheed-High speed and small size are being stressed by Lockheed Aircraft Corp. in efforts to sell its F-104-9 (A-1) June 1, p. 32), based on the assumption that head collision and rear hemisphere will be dominant types of attack for years to come due to missile, fire control and ground control system limitations.

Lockheed feels that superior performance will be required for the fighter and interceptive roles to give a reasonable degree of confidence in attacks against invading aircraft, on view of what is currently known and projected for both current and older guided missile capabilities.

Stripped Down Version

Offering a stripped-down Mach 2 aircraft for interceptive role, the company emphasizes that the F-104-9 Starfighter will have capabilities which will help it modern and able to cope with potential missile attack for years to come.

Among the points Lockheed makes are:
• Aircraft has a potential of achieving steady state flight at Mach 2.2 to 2.4. This is expected to be accomplished with planned engine system controls, the current limitations of Mach 2 on the Starfighter is an engine turbine inlet temperature limitation.

• Aircraft can accelerate in 1.9 sec. from subsonic cruise to Mach 2. With this acceleration, the aircraft is better able to perform an intercept and per-

haps be able to make more than one pass at an attacking aircraft, due to its margin of speed.

• With the lower weight of internal equipment offered at standard equipment on the F-104-9, Lockheed says the airplane's useful load is about 10,000 lb. extended above that of the current U.S. operational airplanes. To make the airplane capable of steady-state flight up to Mach 2.4, some structural modifications would be accomplished in the intake of the engine air inlet ducts. A Pratt and Whitney

would be incorporated, and also a new flameout wind turbine which has high-speed capability at the advanced Mach number.

Data Indicated

Lockheed data indicates that at 35,000 ft. and Mach 2, the F-104 has 17,500 hp in excess of that required to actually maintain that speed and altitude.

Company figures indicate the airplane at this altitude and speed can pull 3g constantly, without losing either speed

Interceptor Attack Tactics

	HEAD-ON	NIAM	REAR
• DETECTION RANGE FOR RADAR SEARCH SYSTEMS.....	MINIMUM	MAXIMUM	ADEQUATE
• DETECTION RANGE FOR IR SEARCH SYSTEMS.....	NEGLECTABLE	ADEQUATE	MAXIMUM
• TIME FROM DETECTION TO MINIMUM SEARCH RANGE.....	MINIMUM	EXCELLENT	MAXIMUM
• RE-ATTACK CAPABILITY.....	NONE	ADEQUATE	ADEQUATE
• IDENTIFICATION CAPABILITY.....	NONE	EXCELLENT	EXCELLENT
• ATTACK CAPABILITY AGAINST MANEUVERING TARGET.....	NEGLECTABLE	EXCELLENT	MAXIMUM
• ATTACK CAPABILITY AGAINST ECM.....	NEGLECTABLE	ADEQUATE	EXCELLENT
• INTERCEPTOR SPEED REQUIRED.....	SLOW	1.2 x TARGET SPEED	MAXIMUM
Conclusion:			
RELATIVE KILL PROBABILITY.....	LOW	HIGH	MAXIMUM

LOCKHEED chart details various attack tactics, with one as the top kill probability.



Why Vertol leads in turbine helicopter design and development

Steady progress in technology has advanced this versatile air vehicle, the helicopter, to the threshold of a new era of usefulness. It is the era of the turbine-powered tripartite helicopter designed for improved battlefield mobility and logistical support of combat elements and missile systems, and for all weather, day-night operations in military or commercial service.

Vertol has been and is today at the forefront in progress toward this new achievement. Among the first to recognize that turbine power would vastly improve performance, capacity and versatility, Vertol also is a leader in research and development on new designs incorporating these powerplants.

The result of many years of work in this field is the Vertol 107, first member of an entirely new generation of multi-turbine helicopters destined to play vital roles in short-range transportation throughout the world. It is now being produced for the U. S. Army as the YHC-1A. The "107" can be adapted to an almost limitless variety of functions without altering basic design. Its built-in growth potentiality has already resulted in a decision by the U. S. Military to procure a larger, more powerful version of the 107 type from Vertol. This growth also assures a steady future progression of helicopters of greater performance, load-carrying ability and versatility.



The Vertol 15-15, first in Vertol's series of turbine-powered helicopters, flown in 1955.



The 10-10 reconnaissancecraft equipped with two GE T-36 turbo-shaft engines, flown in 1957.



The Vertol 105 with two Lycoming T-53 engines used in the test program, flown in 1957.



In 1959 the Vertol 70, powered by the Lycoming T-53 was the world's first successful turbine VTOL.

VERTOL
Aircraft Corporation

MORTON, PENNSYLVANIA

ENGINEERING
ALAN RESEARCH ASSOCIATES INC., BOSTON, MASS.
VERTOL AIRCRAFT CO., HAWAIIAN LEO, HONOLULU, HAWAII

MISSILE ENGINEERING



THUNDERBIRD battery consists of low launcher, a target illuminating radar and control vehicle (left) and battery command post (left center). Field assembly and test post (left) is similar to the facility developed by the Coastal School.

British to Begin Thunderbird Training



TRAINING version of Thunderbird missile is mounted on its launcher in firing position.

London—Two British army anti-aircraft regiments will be equipped with the Thunderbird solid-propellant ground-to-air missile by December of next year. The first regiments will begin training with the missile next month at the Manchester anti-aircraft school in South Wales.

A low-level weapon system which complements Thunderbird is the army's sub-sonic defense is also in development firing unit at Mansel.

Codename "Yellow Fever," the radar for control system of the low-level sub-sonic weapon incorporates a type of tracking radar and computer-aided system which responds to all ranges on other known systems, according to an army technical source. The highest scanning search, computer and the two versions of "Yellow Fever" all operate in a gun platform.

During a visit to Mansel Army Area, West, was shown the high potential rate of engagement of high speed jet aircraft possible with the system.

The gun is a developed version of the Belton light anti-aircraft gun which has a fire rate of 140 rounds per minute. From about 100 yards of the gun's air defense position, the field is the destruction of enemy, low-flying aircraft which is all probability will be missed vehicles. Without such surveillance the enemy is unable to define his target from which attack.

It is now clear with the test of Thunderbird (code named "Red

Shed") in the area that previously reported defects have been overcome with the missile.

Official sources recently confirmed rumors, believe that the Thunderbird was into trouble only during service proving tests at the British Army camp at Mansel, after final engineering changes had been made to meet service requirements.

However, on this stage is not as much possible and an undisciplined, conservative number of rounds was fired successfully before one photographic record revealed partial loss of the control system. The reason, according to one source, was being struck by the lightning during operations, after having been previously over-deflected by a severe condition in the missile's hydraulic system which is designed upon boat operation.

Other reports imply the cause was failure due to a better condition which responded to orthodox treatment.

The Royal Air Force (RAF) ground-to-air missile is also reported to have serious area problems occurring during proving trials. Reports suggest that certain directional change rates could cause forward due to the disturbance of missile airflow to the target.

System Mobility

Even element of the Thunderbird missile system is mobile. A regiment is made up of two batteries each consisting of four launchers, one target illuminating radar and one tactical control unit. Each regiment is considered to be at least as mobile as a conventional heavy anti-aircraft gun regiment, the heaviest ones being the tactical unit which weighs 16 tons. This unit is only a modified version of the unit used with the previous heavy anti-aircraft artillery. The vehicle currently contains both the sensor and display equipment on the same chassis, and the IFF (identification) and a separate equipment.

Future development is likely to see the breakdown of this unit on two chassis, one vehicle containing the tracking equipment with a combined sensor and IFF and another vehicle housing the display consoles and control personnel.

Under a state of alert, reloading of one launcher can be completed in four minutes so that a battery has a five minutes of one round per minute. Nine such, the more will be one round with the target at maximum range and be ready to launch a second round at the same target if necessary. The possibility of engaging each battery with two target illuminating radars has not been ruled out, however.

Target illuminating radars for both Bloodhound and Thunderbird are based



THUNDERBIRD with launcher attached is transferred from battery to launcher battery.



LOW LEVEL weapon system shows two Belton gun and new type radar and computer system. Entire Thunderbird in treatment before a gun, go, target test from vehicle at left.



Boxed tree shows size of GL-20T Super Hercules, superimposed over now-in-service C-130 Hercules



An ocean-spanning logistic support transport, the GL-307 Super Hercules is a "stretch" version of the C-130 Hercules—famous for its headline-making feats in over two years of service with USAF's Tactical Air Force.

The GL-207 Super Hercules has a fuselage 22 feet longer than its brawny brother's. Its wing span is 12 feet greater...its propeller-diameter has been expanded by 3½ feet...internal fuel capacity has been increased to 10,236 gallons for greater range (pylon tanks add another 1800 gallons).

Powered by four new GM-Allison T-61 Prop-Jet engines, the Super Hercules provides nonstop trans-Atlantic and trans-Pacific transport for personnel, vehicles, palletized/containersized freight, mail, and general cargo. Maximum payload: 75,000 pounds.

The G4-297 Super Hercules will come off production lines at Lockheed's Georgia Division. Like all Lockheed aircraft, the Super Hercules is designed for long life, easy maintenance, and low cost of operation. Results, maximum safety, for minimum dollars.



Transporting 50,000-pound MATS cargoes nonstop across the Atlantic—or, with pylon tanks, spanning the Pacific nonstop carrying 16-ton loads 4,800 nautical miles—is a Super Hercules' mission.



Crew efficiency on long flights is assured by flight station design approved by experienced transport pilots. Super Hercules' crew compartment includes cooled crew storage seats, galley facilities for hot meals in flight.



102 wheelchair users, or 116 passengers can be transported in the GL-307. With airline type seats, the Super Bluebird can carry 105 persons comfortably.

Combustion vehicles can be driven up the hydraulically controlled ramp-door of the end-loading GL-207 Sayer Hercules—a vital time-saver in emergency situations.



Big bad little missiles—assembly, with boosters, on trailers, or dollies—fit easily into the huge protruding cargo compartment of the GL-300 Super Hercules.

Assorted cargo — sawlog mending, jet engine components, fuel and oil drums, etc. — can be speedily loaded onto Super Hauler's truck body using these.


LOCKHEED

JET TRANSPORTS - JET FIGHTERS - JET TRAINERS - COMMERCIAL & MILITARY PROPULSION TRANSPORTS - ROCKETRY
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 NUCLEAR REACTOR DESIGN & DEVELOPMENT - AIRCRAFT SUPPORT EQUIPMENT - WORLD-WIDE AIRCRAFT MAINTENANCE

G. E. INERTIAL PLATFORMS shrink missile readiness time to 60 seconds at -55°C



In the event of attack... we cannot expect more than minutes warning and minutes to retake. Hereafter... thermal systems in air-launched missiles required as much as thirty minutes warm up time before operation and an additional amount of time before achieving specified accuracy. The new G. E. Platform is designed specifically to give satisfactory performance over a wide range of temperatures in high G environments.

It is smaller in size and weight than similar platforms and the following features are indicative of the performance to be expected:

1. Fully operable within one minute after power is applied.
2. 30 minutes after -55°C start-it achieves accuracy as specified.
3. Ambient temperature -65°C to +100°C.
4. Tolerates high acceleration environment.
5. Platform and associated electronics total only 55.7 pounds.

This lightweight ruggedized environmentally suited platform is ideal for long range air launched missiles. The unusually low drift rate eliminates the accuracy of "trimming" or adjusting the gyro before each mission.

More complete details are available on the system by contacting Manager—Control Sales, General Electric Company, Light Military Electronics Department, Amman and Control Section, Johnson City, N. Y., Dept. 12A.



GENERAL ELECTRIC

LIGHT MILITARY ELECTRONICS DEPARTMENT
FRENCH ROAD, UTICA, NEW YORK

ally under. Both are made by British Thomson Houston Co. Ltd., but in the interests of mobility, the new equipment had been made larger and heavier and must necessarily have exceeded some range.

A notable feature of the Thunderbolt's version has been its adoption of standard arm vehicle chassis for ease of maintenance at the runway. This has greatly reduced the development cost of the system as a whole, the arm chassis.

The latter contained post is a standard Thunderbolt housing for the display equipment associated with the radar display and it houses a special loop radio signaling system which enables the technical control officer to

use voice and reserve, information. The hardware was an adaptation of the standard Bolon light aircraft gun platform and the launcher loading vehicle is also an adapted arm vehicle which has a hydraulic and extending arm to enable the missile and clearing frame to slide from the launcher into the launching platform without manual effort.

The field assembly and test point is basically identical to the facility developed for the Capson missile.

Efficiency of the arm, towing, handling methods were well demonstrated. One feature of the training program is an instructional model which simulates the complete radar control and firing system.

test firing is hard to obtain because of the difficulty of obtaining all the data that is needed.

A year ago, ARMA heard the first test to find out whether simulation would work, and this was the first of the contract is now being completed. A missile has been built which roughly corresponds to the fuel tank in the lighter intermediate range, before the missile. Southwest Research has found results from this model system to be in close agreement with ARMA tests with a full scale tank.

During the development phase of the program, the Institute will look into various sloshing phenomena and problems, and will evaluate various tank designs and their use of the device currently used to suppress sloshing motions. These investigations will be general, and the program is not aimed at development of any specific missile hardware. In the simulation process, choices in the sloshing field can be directed out with experimental data.

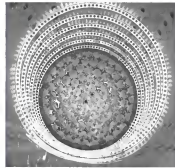
Simulation built in Southwest Research is a general type of test, and it could be adapted to any vehicle or tank configuration. With such flexibility, missile designers could use tests later in the same way that aircraft designers use models in wind tunnel tests to measure the characteristics of a system before the full scale hardware is built. Thus, once the fuel tank configuration has been chosen, such tests could provide information on sloshing that a model would be good over engineers and other designers who must consider sloshing frequencies in developing missile systems.

Tank Model

The tank model used in the simulator has rigid walls, and the liquidary program has not gone into the area of structural vibration, although Dr. Anderson and his team of engineers are now working on this. Data from the model system is handled with straightforward mathematics to reflect the simulation. Reynolds number is accounted for in computing results.

Along with calculating tank design and general sloshing characteristics, the model can be used to investigate the various types of sloshing device designs used to suppress sloshing motions. An example of these devices is a perforated brass core with a cone at each end which is fitted in the axis of the field in the tank to act as a further suppressor. Other designs such as rings and cones on the tank walls can be checked.

In simulating a tank, Southwest Research technicians don't use the fluid which will go in the full scale tank. They had a fluid with the appropriate kinematic viscosity which acts in the



PERFORATED brass core sloshing in fluid in a model tank model set in motion suppresses. The core around the tank will suppress sloshing core in axial tank.

Missile Fuel Sloshing Simulated

By Craig Lewis

Sea Airborne-Simulation techniques for characterizing fuel sloshing characteristics of liquid rocket engine fuel tanks has been developed here by the Southwest Research Institute.

Designed for the Army Ballistic Missile Agency, the simulation will be used as a research tool to measure fuel sloshing phenomena and problems. It also has a design and development application in a system of evaluating slosh

ing characteristics of specific tank systems for ballistic missiles.

Southwest Research Institute built the simulator for ARMA in an effort to get a more realistic means of evaluating design problems. Most of the work done in the area has been in developing theoretical solutions, and Dr. H. W. Anderson, manager of the engineering section at Southwest Research, observes that full studies are too complex to analyze theoretically. He also points out that information from actual

NO.
TO <i>W.J.R.</i>
FROM <i>C.M.T.</i>

STATIONERIES, ELEVATIONS AND LAND SURFACES. MAPS OF THE U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C., 1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 258

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HOW SAC'S "HOUND DOG" SCENTS ITS TARGET



The crew of the B-52G starts up the jet engine of the sharp-nosed GAM-77 Hound Dog missile hung under its wing...gives its inertial autonavigator the location of the target.

On a "far-real" mission, the Hound Dog would leap toward its target at supersonic speed—very likely a ground-defense center hundreds of miles away. Its guidance system can't be jammed...can't be decoyed.

Purpose of the GAM-77 air-to-ground jet-powered guided missile is to increase the striking power of Boeing's B-52. Sling a pair of Hound Dogs under the wings of the new B-52G—and you have what amounts to a brand-new weapon system.

The GAM-77 program was started in August, 1967. The missile has been put into accelerated development. It already is in its early flight test phase...will be deployed by 1969.

Weapon system contractor: the Missile Division of North American Aviation.

MISSILE DIVISION



NORTH AMERICAN AVIATION, INC., DENVER, COLORADO

value of the bearing angle, that is, from the target is positive (with 45 deg. in the last five orders, the computer employs tangent functions to obtain a solution, even though four individual squaring operations are required. The use of the tangent squares reduces digital switching logic by a factor of two to one at the expense of only slightly more complex squaring.)

Hallamore to Design Titan TV Equipment

Hallamore Electronic Division of Seeger Corp. has received new contract awards totaling \$100,000 from the Mission Co., Dayton, for the Titan missile development program.

The \$11 million development by Hallamore for the Titan program provides a four-point project to include development and installation of photoptical, film camera and closed circuit TV systems and line communication facilities involving telephone and intercom circuits.

Closed circuit television equipment to be installed will be used at the Titan static test site and exhibits the latest version of Hallamore's ruggedized camera and built-in stabilization of up to 10% with a day but from the target point of test items, with residual camera temperatures in the frigid perimeter.

Nortronics Studies Guidance Checkout

Northrop, Calif.-Fulbrighters and so on are being conducted by Northrop Division of Nortronics Corp. on an advanced system for checking features of weapon status, speed, with inertial guidance. The concept, called "War can" would be designed for use with so-called ballistic missiles, aircraft launchers, anti-aircraft missiles, and high performance rockets, and represents an extension of engineering accomplishments in the field of computer.

Flexibility of the concept provides a computer system which can be used during launch, checkout, engineering test or field operation of a weapon system. Norton can be adapted for both of flight control guidance for control, command-and-control navigation and homeing systems.

Norton involves a self-checking, automatic computer program device capable of self diagnosis. Heart of the system is an internally programmed computer with a magnetic drum as its principal memory unit, designed to have storage capacity of 100,000 bits of information.

A feature of the concept is the com-

SPACE ORIENTED ELECTRICAL ENGINEERS AND PHYSICISTS

Put non-space and missile projects first, control outstanding opportunities in research, development and design at Douglas. Here are some of the areas in which we have immediate openings for engineers and physicists with advanced degrees (B.S. also considered):

SPACE NAVIGATION—Efficient Radio and Gyroscopic techniques, root loci, 2-D phase, quasi-linear, asymptotic and other techniques in the analysis and development of guidance and control systems.

SPACE COMMUNICATIONS—Satellite system research and development, research in wave propagation in ionized gas, high frequency ionospheric and auroral wave areas.

SPACE POWER—Unconventional power research and development to supply power to space systems and on other planets.

LOGICAL DESIGN—Solid state digital circuits are applied to automatic test and firing equipment, reduction of complex mechanical and logic circuitry, and utilization of computers in detailed circuit design.

SYSTEMS DEVELOPMENT—Complete research, advance design and development of various and various systems for use on space vehicles.

For full information write to Mr. G. C. LeRue, Staff and Vice President, Engineering, Box 6204, Douglas Aircraft Company, Inc., Santa Monica, Calif.



The most sophisticated in aircraft, missile and space technology



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Deriving engines from passenger jets and jets, the C-474V-1 is a turboprop engine of the future.

You can rely on a quiet cabin and easy maintenance through low type systems which are not complicated by engine parts.



SUD AVIATION

2700 West 10th Avenue, Suite 100, Denver, Colorado 80202

SMALLEST LIGHTEST CARCINOTRONS

with wide band sole tuning



Though it has just recently made its debut into the high society of Litton microwave tubes, the M-Type carcinotron (see model L-3290) has already been commended by the military for its exceptionally close design. Every aspect concerned with upgrading the performance of ECM equipment will surely find much of interest in this medium-power tube, with which Litton takes a major stride toward truly instantaneous non-pulsing capabilities by allowing faster tuning rates than any previously attainable.

The Litton family of right electrically-compatible carcinotrons is the first to incorporate the critical capability of wide band sole tuning without frequency or power holes when the tube is operated into as much as a 3-to-1 bandwidth. Litton carcinotrons are the first to use wider-than-normal band RF output coupling, encompassing many system components such as antennas, waveguide plumbing, and load isolators.

We cite three items not for glory's sake, but rather for their meaningful contributions to more efficient system design, smaller size and lighter weight.

The notable suitability of these carcinotrons is not limited to ECM. You can also consider them for other military applications such as drivers for communications links—in fact, wherever medium-power tubes with extremely rapid tuning and low temperature are required. And when you are considering, remember these carcinotron tubes are not just drawing board products—you can order them now.

Feel free to lodge your inquiry about technological power capabilities of whatever nature with us at Litton Industries Electron Tube Division, Office 46, 968 Industrial Road, San Carlos, California. Your request for our new catalog or for answers to your specific questions will be handled promptly.



LITTON INDUSTRIES Electron Tube Division

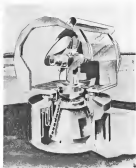
MAINTENANCE • REPAIRS • CARCINOTRONS • TRAVELER WAVE TUBES • RADAR WAVE OSCILLATORS • GAS BEAMER TUBES
X-RAY TUBES • SPECIAL ION TUBES • BRIDGED-TUBE AMPLIFIERS • HIGH-POWER FILTERS • DIODES • TWTs

CAPABILITY THAT CAN CHANGE YOUR PLANNING



Radar Tracker Developed for Atlas ICBM Squadrons

After international ballistic missile guidance error (left), to be used as only Atlas squadrons is able to determine position of the missile with an accuracy of better than one part in 100,000, according to General Electric's Guidance Department, which produces the radar tracking antenna. Tracker is confined to a volume (dashed at right) whose top position is controlled to within 1 deg. To achieve its high accuracy, the tracking cone of the radar's 4 ft. diameter horn is narrowed to tolerances of 50 microns (0.0005 in.) of an inch. Guidance power drives penrose tractors to move it constantly from outer without lock-in or acquisition.



selective order, which Northrop engineers claim they can build into the system. That would furnish an indication of the proximity of a "go" reading to the drop center of the area involved. Engineers also are studying the possibility of a shift radar to provide instant production due to drift.

Expansions, Changes In Avionics Industry

Computer Sciences Corp., Los Angeles, as a new company located to serve both computer manufacturers and users in desirable studies, applications programming and problem analysis for both scientific and data processing work. Computer is headed by Fletcher Jones, former general supervisor of integrated data processing at North American Aviation's Columbus Division.

Other recently announced expansions and changes in the avionics industry include:

- **Hemlock Electronics Co.** is the new name of the former Elcom Electric, Inc., Cambridge, Mass.
- **Cassell Electronics Corp.** is the name of a new company formed to develop and produce its own electronic test components. Dwight Cassell is com-

pany president. Company address: 485 Quince Lane, San Jose, Calif.

- **Spery Gyroscopic Co.** plans \$6 million expansion of its microwave tube facility at Gainesville, Fla., with a 15% increase in plant space to a total of 121,000 sq ft. Employment is expected to reach 800 by mid-1968. Spery gyro Company also has acquired a 13,600 sq ft. building in Tucson, Long Island, N. Y., to house equipment for this associated with Sperry Navigation equipment for Polaris launching submarine.

- **Loe, Inc.** has divided its former Grand Rapids Division into two new divisions. Instrument Division, headed by J. M. Walsh, will be responsible for flight instruments, gyro and stabilized platforms, submarine bombing system and ground support equipment. Electro Mechanical Division, headed by T. E. Gervase, is responsible for aircraft lamp-power sockets, antennas and control systems.

- **North American Avionics Division** has started construction of new 112,000 sq ft manufacturing facility near its main plant in Downey. Completion is scheduled for January.

- **Consolid Industries, Inc.**, Wallingford, D. C., has acquired General Electric's high voltage electron tubes for commercial and military uses.

- **Raytheon Co.**, Hallowell, Me., has been awarded a contract by the U.S. Navy to develop and produce a new type of radar antenna. The contract is for a total of \$1.5 million.

- **General Electric Co.**, Schenectady, N. Y., has been awarded a contract by the U.S. Navy to develop and produce a new type of radar antenna.

- **International Electronic Research Corp.**, Berkeley, Calif., has been awarded a contract by the U.S. Navy to develop and produce a new type of radar antenna. The contract is for a total of \$1.5 million.

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...NEWS IS HAPPENING AT NORTROP



For the Black Hawk, Nortrop is supplying Raytheon Manufacturing Co. with the loaders, launchers, and auxiliary loading equipment. Throughout concept, design and production, Nortrop has kept this program on an accelerated schedule.

NORTRONICS TOTAL GROUND SUPPORT —KEY TO DEFENSE READINESS!

By integrating mechanical, electronic and servo-hydraulic skills into a wide variety of ground support equipment applications, Nortronics demonstrates an understanding of the total weapon system.

Nortronics conceives, designs and manufactures GSE around a knowledge of the weapon's mission, its operational and maintenance concepts, and the facilities and skills of its field operators.

Twenty years of specialized experience gives Nortronics the ability to get the job done — to translate your most complex GSE requirements into reliable hardware — on time — and at minimum cost.

For immediate help with your GSE requirements, call Nortronics today. Or write: Chief Applications Engineer, Dept. 2003-D3, Nortronics, 500 E. Orangeburg Ave., Anaheim, California.



Shown above: Nortrop's T-45 Typhoon, F-41 Stealth and SM-62 Hawk — all are of the Nortrop's mechanical, electronic and servo-hydraulic GSE application line.



NORTRONICS

A Division of
NORTROP CORPORATION



FAA Begins Facilities Center Construction

Federal Aviation Agency's 8,500-acre facility at Atlantic City, N. J., will be used to develop efficient air traffic control for civil and military flying. Various approach configurations are evaluated with equipment showing downwind or crosswind to determine high altitude approach between 300 ft. and 1,000 feet. That data is in Douglas C-142, which has made several landings at area airfield and Atlantic City.



Longest survey, now 35,000 ft., will be extended to 12,000 ft. this year and a parallel 12,000 ft. survey will be completed, as shown in the field layout above. Next year, another, and parallel, survey will be built a mile distant. Total base perimeter, including approach structures, will exceed 1,000 ft. next 18 months. Below is the new control tower for National Aviation Facility Center operations.



CHOOSE REDA PUMPS FOR YOUR AIRCRAFT REFUELING SYSTEMS!



REDACOR® pumps in Tulsa Municipal Airport using Reda Jet Fuel System.

REDACOR® pumps in Tulsa Municipal Airport using Reda Jet Fuel System.

- **Design and Installation** — no surface structures.
- **No Electrical Hazards** — 40% approved safety.
- **No Drilling Holes To Tank** — make it pump & run out.
- **High Volume at Rapid Rates** — speeds from 1 to 120 GPM — capacities to over 1000 GPM.
- **No single or double hybrid systems** — tank back and feed relief system.

Designed as a typical Under ground Storage and Dispensing Refueling System with Reda Jet Fuel Submersible Pumps, used by Commercial Air Lines. This system uses two 1000 GPM pumps and two 1000 GPM pumps feeding into a three and a half hybrid refueling system. It has proved to be the most efficient in fuel economy and maintenance time in commercial tank system.



REDACOR® pumps in Tulsa Municipal Airport using Reda Jet Fuel System.

REDA PUMP COMPANY
Manufacturing Division

REDACOR® pumps in Tulsa Municipal Airport using Reda Jet Fuel System.



Collins Rodor Measures Ground Speed, Drift

New Collins Rodor Co. Doppler radar for measuring ground speed and drift angle now operates from sea altitude up to 50,000 ft. The system, including panel instruments, computer, tracker, transmitters receiver, control and antenna (shown at right) weighs 564 lb., or 504 lb. of dual installation. The system is fully demonstrated using 15 tubes and 40 transistors, and consumes 200 watts of power. The antenna provides three losses and is a fixed line, horn-fed type with no active elements. System is accurate to 0.6%.

FFITT FILTER CENTER

Master Flight Data Station—Lithium Industries has a new Wright Air Development Center competition to develop an integrated master data and control system for multi-engine operating at

altitudes up to 200 mi. Station will include gyro stabilized platform, external environment sensors, autopilot and digital computer. Edgipac-Prattner is major subcontractor to Lithium.

Crystal Ball Gazing—Electronic Industries Association predicts that silicon will be upgrading \$14 billion annually

for aircraft, missiles and space in 1970 and that 41% of this figure (\$6 billion) will go for electronics. Of that sum \$15 billion total, approximately 55 billion or 37% goes for electronics. EIA estimates. Current military electronics expenditures, including ground and ship-based equipment, estimated at approximately 55 billion, are expected to reach \$12 billion by 1970, EIA says.

New Magnetron Potentiometer—New conductor device whose resistance can be changed over a 10:1 range through application of a 16 kilohm resistor field, or a wider range of stronger field is used, is now available from Ohio Research, Inc. New Magnetron can be used as a contactless potentiometer, transducer, voltage regulator or power amplifier. For industrial, scientific, and military use, the company is at 1015 West Third Ave., Columbus 6, Ohio.

Subminiature Time Totter—Naval lightweight, low-cost device for keeping track of usage time accumulated by various equipment has been developed by Red Bank Division of Bendix Aviation. Device is a subminiature piezoelectric tube, Type 7114, with a collector whose resistance decreases linearly with time up to 1,000 hr., when d.c. voltage of 140 to 250 volts is applied. By measuring resistance of tube in use, time of accumulated equipment can be determined. Publication K914 gives application data. Company address: Bendix Corp., N. J.

Widespread Innovation—Western Electronic Convention (Wescon), to be held Aug. 18-21 in San Francisco, will feature some of its sessions to offer small papers instead of the four or five-

minute sessions into technical sessions. Another innovation will be a round of several papers in the field which will be invited to comment at the conclusion of each paper. Copies of Wescon papers will be distributed at time of registration according to Western officials.

UML, First Tape Pass Reliable—Flight tests to determine reliability of new AMP tape pass type of solid-state counters in solid-state systems conducted by United Air Lines using special fixture with 400 tape pass transistors revealed not a single failure during 5,000 hr. of flight time extending over 14 year period. Test unit was in storage in which the roll of a DC-7 engine nacelle where it was subjected to continuous vibration, temperature cycling and exposure to various types of liquid fumes up during island and loading.

Signed on the Dotted Line—Major contracts recently awarded by various manufacturers include the following:

• **Mallick**, \$2.5 million award from Air Materiel Command for flight simulators.

• **Westinghouse Electric's Electronics Division**, \$5 million contract from Navy Bureau of Ships, for "parametric" radio communications transmitters.

• **Alconit Instruments, Inc.**, Cedarville, Md. \$401,780 contract from Area Ordnance for development of an electro-optical fire control system for night-time sighting of ordnance equipment. Allen B. De Mott Laboratories, Inc. is major subcontractor on the program.

• **Watts King Corp.**, Los Angeles, \$100,000 contract from Eastern Air Lines for flight simulators to be installed on airline's fleet of DC-8 jet-liners.

• **Johns-Cramer Manufacturing Co.**, Airborne Division, Racine, Wis. contract from North American Aviation for its flight prototype conducting experiments for use on B-70 Mach 3 bomber.

• **Tops Industries, Inc.**, Los Angeles, \$100,000 contract from Federal Aviation Agency for WOB, on-board equipment.

• **The Magnus Co.**, Ft. Worth, Ind., has received initial contract for \$17.5 million for six lightweight radar. Company says it expects additional large orders for the equipment.

• **ITT Federal Division**, Clinton, N. J., has received order for distance measuring equipment (DME) for 100 F-4E's. TWA's 18 new jetliners. Company says the \$11.4 million contract for duplex high-powered radio amplifier for data link guidance system used with B-56B air defense network.

6

ways to solve CONTROL PROBLEMS

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with DONNER ACCELEROMETERS

Donner 4000 series 0.1G transducer

Donner 4000 series 0.1G transducer can be mounted in a number of ways to solve various control and measurement problems. Typical applications include:

- Acceleration in vibration, shock, and impact tests
- Acceleration in vibration, shock, and impact tests
- Acceleration in vibration, shock, and impact tests

Model 4000 0.1G transducer

Model 4000 0.1G transducer



Coil Wound for Mach 20 Wind Tunnel

General Electric technicians wind an asbestos coil, believed to be the largest yet built, to store energy for an Air Force hypersonic wind tunnel at Arnold Engineering Development Center, Dayton, Ohio. Wound out of 2 coils, about an inch in diameter, with 60 turns and about five feet high, Company says the coil will have 3,000,000 amp of current flowing through it and must withstand magnetic clamping forces as high as 6,000 tons at shutdown. This energy is discharged in a superheated gas to explode compressed air, driving it through the tunnel at Mach 20.

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WING TIPS



DON'T CHANCE IT. Many a hot-shot pilot thought he could make it! You may think you know the way like the back of your hand, but don't chance it during hazardous weather. Turnaround conditions for visual or instrument approaches and flight paths were set up for your safety—follow them!



AVOID "HEADACHES." Rough weather, grinding brakes or snap crash landing will cause injury of some sort if you're not strapped in securely. Check your seat belt and shoulder harness periodically for rattle and wearage during heavy turbulence and avoid "bushwhacker!"



STAY "ON THE STRIP." It's rare to make someone else taking too long the cause of accident procedures and nose-up accidents. Be alert all the time—wind gusts, last-minute turns, overcorrections and near misses if not headed toward safety can be easily. Remember, you're still flying 'til it's parked.

REMEMBER: Fly "Happy Flight!"... look for the famous Esso Signs From Motor to Mustang.



ESSO PISTON AND TURBO OILS. Up there, you rely on your engine and your engine relies on an oil for proper lubrication. Esso Aviation Oils meet all high-temperature stability and help prevent piston ring gumming and harmful carbon deposit formation. Whether your plane be large or small—prop or jet—look to Esso for the best possible lubricants for your aircraft.

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Highways or Skyways... "ESSO RESEARCH works wonders with oil"

BUSINESS FLYING

Swiss Pilatus Porter Begins Flight Test

By Edith Walked

Stans, Switzerland—First prototype of the Pilatus Porter six-seater twin-engine prop aircraft, built by Pilatus Flugzeugwerke A. G., has reached the flight test stage.

First production series of this model has a long commercial life. A public demonstration of the Porter is scheduled for this year's Paris air show.

Design is based on the Pilatus T-4 type of which the first prototype only one prototype is less than a year ago. Price will be about \$40,000.

The Pilatus Porter is a single engine, six-seater, high wing plane, all conventional appearance.

Design features specified by the main manufacturer:

- Short takeoff and landing characteristics.
- High rate of climb.
- High useful load.
- Multi-purpose suitability.
- Low purchase price and low cost of operation and maintenance.

The basic plane is of light metal construction. In two fuel tanks are located in the wings, one on either side of the fuselage. Landing gear has landing flap and skids.

Powerplant is a single turbocharged, inverted, Lycoming 540 at 260 hp, liquid-cooled at the purchaser's option.

The two large wheels of the main landing gear are fitted with low pressure tires and have doors hinged.

Pilot's seat is on the left of the fuselage immediately in front of the wing leading edge. There is room for one passenger alongside the pilot. From the back of the seat's seat to the side wall, the cabin measures 7.0 ft long and 3.8 ft in width.

Door is 5.5 ft wide and fits flush with the front of the cabin. It is made in two pieces and closes in the middle with no center support. It is a non-structural component; the plane can function in without the door.

A hatch measuring 7.0 ft x 3.5 ft is built into the floor of the cargo area. Through the opening hatch can be changed or a canvas can be fitted to the hatch. The hatch can be opened as closed from the cabin during flight.

Because of the position of the dipstick, the exhaust is lateral on the left and the cabin door on the right side of the fuselage. If the hatch is open in the plane is flying without a



ALL-METAL Pilatus Porter's wing leading edge has landing flap and skids.



TWO fuel tanks are in wings on either side of fuselage. Note double door below.



3-D Radar Tells Distance, Altitude

Distance — Please see Page 34

Army Unveils A Faster Radar System

Nuclear System
A nuclear power plant is under construction at the site of the former power plant. The new plant will be a pressurized water reactor (PWR) and will have a capacity of 1,000 megawatts. The plant will be owned and operated by the American Nuclear Energy Corp. (ANEC). The plant is expected to be completed in 1990.

U.S. Reveals New Radar

New Robot Instrument
A 1-1/2 cubic ft. (40-lb) time-recording robot studies distance traveled, speed of forward and backward motion. The April 15, Washington

with Unve
Revolution

Radat De

THE WALL STREET JOURNAL
Wednesday, October 26, 1989

Army Tests Improve
Radar Detection Of
Developed for N

Army Shows Bolder
With 1st Division

[illegible]

Army Unveil Hughes Rad

Electronics. The new
30% further than previous

New Radar Imp Lir Defense for

[illegible]

**A new field...a new future...
for the forward-looking engineer!**

The first radar system capable of simultaneously detecting range, bearing and altitude from a single antenna, transmission, and receiving channel... Frecomar is a major breakthrough in radar technology.

Developed by Hughes Follerton, the Focuser antenna operates on a new electronic principle called frequency steering. The position of the radar beam is changed by varying the frequency of electromagnetic energy applied to the antenna. Thus the beam can move at lightening speed to handle more targets with greater accuracy than with conventional radar.

The unique concept spans entirely new fields for radar, including a great many as yet unexploited. Hughes Electronics needs creative engineers who can step in and help develop these new military and civilian applications.

While Hughes Fellowship places emphasis on advanced development, it is a completely integrated engineering and manufacturing organization... whose activities cover a wide range of electronic and electromechanical applications.

Now expanding rapidly, Hughes is offering imaginative engineers a number of new positions. If you are interested in stimulating work with solid opportunity for personal and professional growth, we invite your inquiry. Please contact Mr. L. V. Wilks at address below.

HUGHES

GROUND SYSTEMS
PERSONNEL SELECTION AND PLACEMENT
HUGHES AIRCRAFT COMPANY
FULLERTON T. ORANGE COUNTY, CALIFORNIA

3-D Radar
Developed
by Hughes

Computer Board
Range, Altitude
Single Operation

NEW YORK —
WEDNESDAY,
Army Gets
Improved
Field Radio

3-Dimensional Radar Is Displayed by Army



STANDARD Kibbo's 1-hour design built out at Eucalyptus Hillside has a top speed of about 300 mph.

Borgward Kolibri I Nears Production

Bonaco-Pruel configuration of Germany's first postwar helicopter gun type, Kobber I, is now being type and flight tested at the Bonaco field of automobile manufacturer Carl F. W. Bonaco GmbH.

Construction of the scored prototype is well advanced and will be followed by a series of construction models.

Designed by Prof. Heinrich Focke, who has been working as a consultant for the last 25 years, the Kolibri 1 has been developed with the financial and technical support of Dr. Carl Bueger, head of the Messerschmitt firm (AW. Mac. 1958, p. 296). Focke, and his team of about 25 engineers, have taken two years to develop the Kolibri 1 from design board to present status of ground test and flight trials.

Deceased from the start as a citizen.



POWERPLANT is a 1-cylinder 37015-54A diesel engine 268 hp. Gross weight is 2,402 lb.



HEAD VIEW of Bernard Kolbe (left) shows configuration of twin tail rotors. Aircraft is in early assembly stage at Vols.



NEW PROGRAM

Raytheon enters new weapons systems program and offers advancement opportunities for both Junior and Senior electronics engineers with experience in the following fields:

- Microwave engineers—component and antenna design
- Communications systems
- Guidance systems
- Computer systems
- Radar systems
- Inertial reference systems
- Feed-back control
- Auto-pilot
- Ground support
- Electronic packaging engineers
- Radar systems engineers (project management)
- Electroinstrument engineer for missile control and auto-pilot design (project management)
- Mechanical engineer experienced in ground handling of large missile systems (project management)

You and your family will enjoy the many advantages of living in the metropolitan Boston area. Relatively noisier and modern housing.



Boston in Eastern

Please forward resume to:

Mr. W. F. O'Mella
Employment Manager
Raytheon Manufacturing Co.
Bedford, Mass.

or call collect
Crosview 4-7100
Extension 473

Borgward Kolibri I	
Specifications	
Equipped weight	1,732 lb.
Ethanol fuel	
Fuel	220 lb.
Oil	15 lb.
Pilot	175 lb.
Two passengers	340 lb.
Baggage	11 lb.
Gross weight	2,492 lb.
Performance	
Top speed (approx.)	300 mph
Cruising speed (approx.)	175 mph
Speed in level flight	12 mph
Speed in steep climb	12 mph
Landing speed from altitude	31 mph
Rate of vertical climb without	
ground effect	147 ft/sec
Rate of vertical climb	750 ft/sec
Maximum climb without ground	
effect	1,400 ft
Normal climb without ground	
effect	11,300 ft
Maximum climb with ground	
effect	400 ft

ent engine, this helicopter meets the U.S. Federal Aviation Agency's stringent requirements which have been adopted by the German Ministry of Transport.

It is expected to sell for between \$37,990 to \$19,900 and will probably be marketed through the Raytheon automobile engine firm.

First prototype was flight-tested at the beginning of this year (AVR Feb. 21, p. 77).



Italians Build Private Jet

First prototype of two-place MEI 400 Cubic private plane, powered by an AGO, three Turbomeca Makuta II turboprop is among competitors in Milan, Italy. Flight tests are expected to begin later this spring. A second prototype is in an advanced stage of construction. Intriguing design feature of the Cubic (AVR Jan. 18, p. 184) is one of distinctive aluminum-plated panels for covering the nose and fuselage. Top speed of the Cubic is expected to be approximately 370 mph.

Crosswind Gear Designed for Cessnas

Ground landing gear, designed to overcome "tailwind" tendencies, successfully experienced its first flight, equipped with a safety air gear, conditions, has been granted a Supplemental Type Certificate by Federal Aviation Agency.

Developed by Jerry H. Goss, one of the key figures in the Department of Commerce's small plane development program in the mid-1950s, which resulted in popularizing bicycle landing gear, the new crosswind landing gear equipment is applicable for installation on Cessna 172 and 175. In flight tests for FAA, a Cessna 172 fitted with the Goss gear was operated from a hard surfaced runway, with short crosswinds varying from 20 to 40 mph, all landings being made without encountering difficulty and little concern for drift being required after landing ground, the inventor notes.

The Goss gear, which stands for \$240 per set, consists of two large knobby wheels by a one-inch ball bearing at a center pin, allowing damper springs on the heels, and centering springs. One ball is bolted to the Cessna single strut and the other to the axle.

Goss points out that while bicycle landing gear, the reflector was originally at an angle of about 60 deg. to the toe wheel frame, whereas with the bicycle landing gear the reflector was in parallel to the axle loads. Landing on the bicycle gear is such that should a pilot feel he is in danger of over tilting

An all new

DEVELOPMENT LABORATORY

at Rohr-Kieser for investigation & development of advanced techniques in

ADHESIVE METAL BONDING

chemical, metallurgical and physical testing

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confidence to

Mr. G. M. Whitehead,

Personnel Manager

ROHR Aircraft Corp.

2206-AW Arlington Ave.

Beverly, Calif.



World's Largest Producer of

Components for Flight

How far can an engineer go at



Someday you may come up on the door of a top-management office of the AC Division . . . or of the General Motors Corporation. This is part of GM's "open door" policy. This means that not only is every GM door open to every employee, but that every open door represents opportunity. Today AC helps fulfill the large demand for aerial guidance systems (with the ACGuard) and many other electro-mechanical, optical and infra-red devices. In the future AC will supply even more instrumental aid needs—both military and commercial—for the "space age." Your long-range prospects at AC can hardly be equaled. You'll gain invaluable experience working shoulder to shoulder with recognized experts in many assignments. You'll enjoy highest professional status, which can be enhanced by working on advanced degrees at engineering schools located near AC top lines. You can work at AC facilities across the country or around the world. In short, if you are a graduate engineer in the electronic, electrical or mechanical fields, you can go places or AC, because AC is going places. This is worth looking into. Just write the Director of Scientific and Professional Employment, Mr. Robert Allen, Oak Creek Plant, Dept. D, Box 746, South Milwaukee, Wisconsin, or Mr. M. Lewis, Dept. D, 1320 N. Dart Highway, Flint 3, Michigan. It may be the most important letter of your life.

Aerial Guidance Systems • Afterburner Fuel Controls • Bombing Navigation Computers • Gun-Bomb-Sight Systems • Optical Instruments • Gyroscopes • Speed Sensitive Switches • Speed Sensors • Temperature • Wind • Altitude

AC SPARK PLUG THE ELECTRONICS DIVISION OF GENERAL MOTORS



over, often his reaction is to slow the replacement by applying brakes—this action may provide just the additional moment needed to complete a rollout, Geise says. He says that tests of a 172 fitted with the conversion gear rebounded during flight in a spin that would have resulted in ejection without the equipment.

PRIVATE LINES

First deliveries of Bell 120B three-place 301hp. utility helicopters have gone to Janet M. Meade, Meade Helicopter Service, Houston, Tex., and Robert Trumble of Jetco Helicopters, Modesto, Ore., both of which will use the two aircraft on a three-month forestry service utility and fire duty contract in Arizona.

Internally re-configured pilot seats are featured in new Douglas DC-3 executive conversion development by Atlantic Aviation Corp.'s Wilmington (Del.) Division. New Castle County airport-based company is installing its "Astric 5" on a turboprop deconstruction line this month.

Two new aircraft light axioms are being developed by Moen-Bader: the MS-550 two-seater and a four-place version. MS-550 deliveries are scheduled for 14 months, reflect the four-year model in 15-25 months. MS-550 is a low-wing, cabinable, fuselage loading gear configuration with 90 hp. Continental. Fully modular, it will have top speed of 131.4 mph, cruise speed of 115 mph and four-hour endurance. Gross weight will be 1,200 lb., empty weight 590 lb. Wingspan will be 36 ft 8 in., length 20 ft 4 in. and height 6 ft 4 in. Price will be under \$4,500 at the factory in France.

Production of executive Douglas B-25, named the Tropic, has been started by L. B. Smith Aircraft Corp., Miami, Fla., which has replaced number one on the list with completion scheduled for September. Program calls for bulk purchased and experienced version of the Tropic.

DC-3 Maximiser speed kits will be needed by Anquap, Inc., in Annapolis, Md., Clark and Venable under a dealer agreement signed with Atlantic Aviation Service Division. In addition, the order will handle the Atlantic DC-3 deluxe gay stay kit.

Metal skin conversion for Piper PA-30 Pacer and PA-32 Tri-Pacer developed by Skyrail Design, Old Star Airport, Langhorne, Pa., have been granted supplemental type certificate

by FAA. Conversion covers wings, ailerons, flap and landing gear and can be accomplished at Skyrail in less than two weeks. Al Skyrail, general manager, reports. Metal conversion adds less than 90 lb. to base weight of airplane.

There are more 75 agricultural service operations with a total fleet of 150 aircraft working currently in New Zealand, according to R. H. Scott, Department of Agriculture. Mr. Scott also notes that there are currently approximately 8,000 farm air strips in New Zealand compared with 5,700 in 1957. He also reports that of the 4175 miles from cities in New Zealand, some

66% are located in terms which is too steep to be properly cultivated by implements.

A \$999,000 115 ft. x 220 ft. mold and runway layout will be built by National Division at Chemung Corp. of Towson, Md., Airport on the east side of the field adjacent to Baltimore Aviation. National Division signed a 10-year lease for the new site with Port of New York Authority at a rental of \$15,000 a year. The project is expected to be completed by Nov. 1. It has the delivery of National Division's General Electric turboprop aircraft five tractors.



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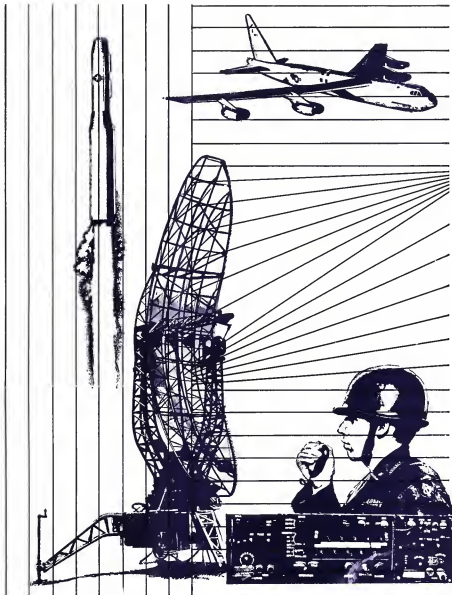
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